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NATIONAL DAM SAFETY PROGRAM. HALEDON RESERVOIR (NJ00021), PASSA--ETC(U)
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LEVEL II

PASSAIC RIVER BASIN

MOLLY ANN BROOK, PASSAIC COUNTY

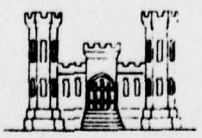
NEW JERSEY

HALEDON RESERVOIR

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

NJ 00021



DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
CUSTOM HOUSE - 2D & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

AUGUST 1978

DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
CUSTOM HOUSE—2D & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

IN REPLY REFER TO
NAPEN-D

Honorable Brendan T. Byrne
Governor of New Jersey
Trenton, New Jersey 08621

27 SEP 1978

Dear Governor Byrne:

Inclosed is the Phase I Inspection Report for Haledon Reservoir in Passaic County, New Jersey which has been prepared under authorization of the Dam Inspection Act, Public Law 92-367. A brief assessment of the dam's condition is given in the front of the report.

Based on visual inspection, available records, calculations and past operational performance, Haledon Reservoir Dam, a high hazard potential structure, is judged to be in good overall condition. Also, the spillway is considered seriously inadequate since 36 percent of the Probable Maximum Flood (PMF) would overtop the dam. The seriously inadequate spillway is assessed as an UNSAFE, non-emergency condition, until more detailed studies prove otherwise or corrective measures are completed. The classification of UNSAFE applied to a dam because of a seriously inadequate spillway is not meant to indicate the same degree of emergency as would be associated with an UNSAFE classification applied for a structural deficiency. It does mean, however, that based on an initial screening and preliminary computations, there appears to be a serious deficiency in spillway capacity so that if a severe storm were to occur, overtopping and failure of the dam would take place, significantly increasing the hazard of loss of life downstream from the dam. To insure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The spillway's adequacy should be determined by a qualified professional consultant, engaged by the owner, using more sophisticated methods, procedures and studies within six months from the date of approval of this report. Any remedial measures necessary to insure the adequacy of the spillway and to prevent overtopping should be initiated within calendar year 1979. In the interim, a detailed emergency operation

plan and warning system, should be promptly developed. Also, during periods of unusually heavy precipitation, around-the-clock surveillance should be provided.

b. Within six months from the date of approval of this report, engineering studies and analysis should be performed to determine the dam and spillway foundation condition and structural stability. This should include test borings to determine material properties relative to stability and seepage and installation of piezometers to facilitate seepage studies. Any remedial measures found necessary should be initiated within calendar year 1979.

c. Within six months of the date of approval of this report, the following remedial actions should be completed:

(1) All brush and trees should be removed from the downstream slope and the area seeded to develop a growth of grass for surface erosion protection.

(2) The erosion which has occurred on the upstream crest of the embankment should be repaired. An effective method of protecting the embankment from future erosion should be implemented.

d. Within three months of the date of approval of this report, the leakage through the joints of the spillway conduits and around the conduit should be repaired. Also, an Operation and Maintenance manual and program should be developed and utilized.

A copy of the report is being furnished to Mr. Dirk C. Hofman, New Jersey Department of Environmental Protection, the designated State Office contact for this program. Within five days of the date of this letter, a copy will also be sent to Congressman Robert A. Roe of the Eighth District. Under the provisions of the Freedom of Information Act, the inspection report will be subject to release by this office, upon request, five days after the date of this letter.

Additional copies of this report may be obtained from the National Technical Information Services (NTIS), Springfield, Virginia, 22161 at a reasonable cost. Please allow four to six weeks from the date of this letter for NTIS to have copies of the report available.

An important aspect of the Dam Safety Program will be the implementation of the recommendations made as a result of the inspection. We accordingly

NAPEN-D
Honorable Brendan T. Byrne

request that we be advised of proposed actions taken by the State to implement our recommendations.

Sincerely yours,

JAMES G. TON
Colonel, Corps of Engineers
District Engineer

1 Incl
As stated

Cy Furn:
Mr. Dirk C. Hofman, P.E.
Department of Environmental Protection
1471 Prospect Street
Trenton, New Jersey 08625

HALEDON RESERVOIR (NJ00021)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 29 June and 7 July 1978 by Harris-ECI under contract to the State of New Jersey. The State, under agreement with the U.S. Army Engineer District, Philadelphia, had this inspection performed in accordance with the National Dam Inspection Act, Public Law 92-367.

The Haledon Reservoir Dam, a high hazard potential structure, is judged to be in good overall condition. Also, the spillway is considered seriously inadequate since 36 percent of the Probable Maximum Flood (PMF) would overtop the dam. The seriously inadequate spillway is assessed as an UNSAFE, non-emergency condition, until more detailed studies prove otherwise or corrective measures are completed. The classification of UNSAFE applied to a dam because of a seriously inadequate spillway is not meant to indicate the same degree of emergency as would be associated with an UNSAFE classification applied for a structural deficiency. It does mean, however, that based on an initial screening, and preliminary computations, there appears to be a serious deficiency in spillway capacity so that if a severe storm were to occur, overtopping and failure of the dam would take place, significantly increasing the hazard of loss of life downstream from the dam. To insure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The spillway's adequacy should be determined by a qualified professional consultant, engaged by the owner, using more sophisticated methods, procedures and studies within six months from the date of approval of this report. Any remedial measures necessary to insure the adequacy of the spillway and to prevent overtopping should be initiated within calendar year 1979. In the interim, a detailed emergency operation plan and warning system, should be promptly developed. Also, during periods of unusually heavy precipitation, around-the-clock surveillance should be provided.

b. Within six months from the date of approval of this report, engineering studies and analyses should be performed to determine the dam and spillway foundation condition and structural stability. This should include test borings to determine material properties relative to stability and seepage and installation of piezometers to facilitate seepage studies. Any remedial measures found necessary should be initiated within calendar year 1979.

c. Within six months of the date of approval of this report, the following actions should be completed.

(1) All brush and trees should be removed from the downstream slope and the area seeded to develop a growth of grass for surface erosion protection.

(2) The erosion which has occurred on the upstream crest of the embankment should be repaired. An effective method of protecting the embankment from future erosion should be implemented.

d. Within three months of the date of approval of this report, the leakage through the joints of the spillway conduits and around the conduit should be repaired. Also, an Operation and Maintenance manual and program should be developed and utilized.

APPROVED: James G. Ton

JAMES G. TON
Colonel, Corps of Engineers
District Engineer

DATE: 27 Sep 78

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam:	Haledon Reservoir Dam, I.D. NJ00021
State Located:	New Jersey
County Located:	Passaic
Stream:	Molly Ann Brook
Date of Inspection:	June 29, and July 7, 1978

Assessment of General Condition

Haledon Reservoir Dam is in good condition with wet areas evident along the toe. However, no flowing seepages were found. The downstream slope is heavily overgrown with brush and trees, and there are several minor small erosions at the upstream edge of the crest due to minor riprap failures. The spillway inlet and conduits are in good condition, but there is significant leakage around the left conduit pipe at the inlet structure. There was also minor leakages into the conduits at the pipe joints.

The general condition or adequacy of Haledon Reservoir Dam is considered questionable in view of its lack of spillway capacity to pass the PMF, or even one-half of the PMF without overtopping the dam. The spillway is capable of passing a flood equal to 35% of the PMF.

At present, the engineering data available is not sufficient to make a definitive statement on the stability of the earth embankment.

The following remedial actions, therefore, are suggested along with a timetable for their completion.

1. Studies to augment the spillway discharge capacity should be undertaken within six months.

2. Repairs should be made within 3 months to stop the leakage through the joints of the spillway conduits and around the conduits in the inlet structure.

Furthermore, while of a less urgent nature, the following additional action is recommended and should be carried out within a reasonable period of time.

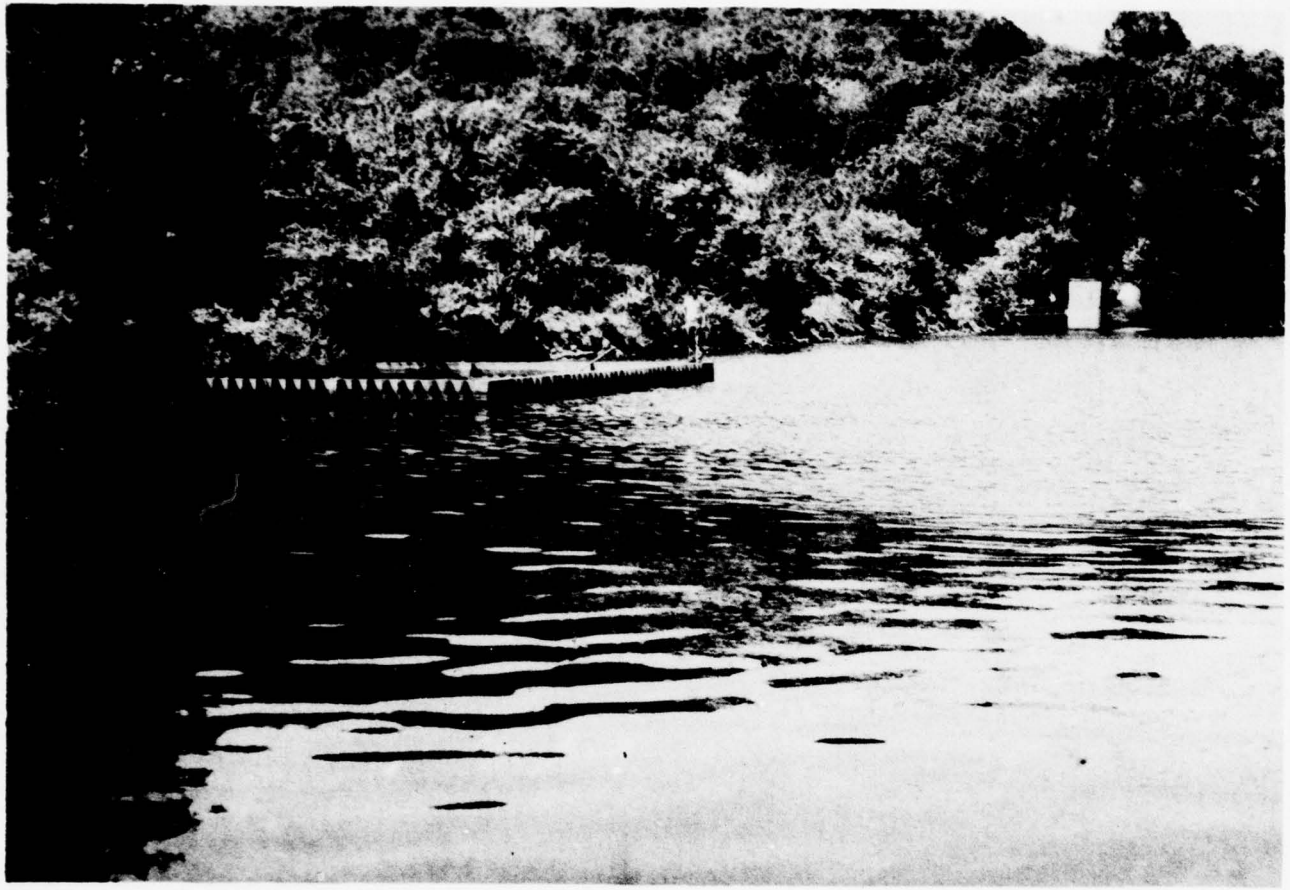
1. All brush and trees should be removed from the downstream slope to avoid problems which may develop from their roots. The embankment should then be seeded to develop a growth of grass for surface erosion protection.

2. A program should be developed to monitor possible seepage through the embankment.

3. The erosion which has occurred on the upstream crest of the embankment should be repaired. An effective method of protecting the embankment from future erosion should be implemented.

Robert Gershowitz

Robert Gershowitz, P.E.



LAKE HALEDON RESERVOIR June 29, 1978
Dam, spillway, trash guard and water supply intake gate house.

TABLE OF CONTENTS

ASSESSMENT OF GENERAL CONDITION

TABLE OF CONTENTS

(Continued)

PLATES

APPENDICES

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

HALEDON RESERVOIR, ID. NJ00021

SECTION 1: PROJECT INFORMATION

1.1 General

a. Authority

The National Dam Inspection Act (Public Law 92-367, 1972) provides for the National Inventory and Inspection Program by the U.S. Army Corps of Engineers. This inspection was made in accordance with this authority under Contract C-FPM No. 35 with the State of New Jersey who, in turn, is contracted to the Philadelphia District of the Corps of Engineers.

b. Purpose of Inspection

The visual inspection of the Haledon Reservoir was made on June 29, and July 7, 1978. The purpose of the inspection was to make a general assessment as to the structural integrity and operational adequacy of the dam embankment and its appurtenant structures.

c. Scope of Report

This report summarizes available pertinent data relating to the project; presents a summary of visual observations made during the Field Inspection; presents an evaluation of hydrologic and hydraulic conditions at the site; presents an evaluation as to the structural adequacy of the various project features; and assesses the general condition of the dam with respect to safety.

1.2 Description of Project

a. Description of Dam and Appurtenances

Haledon Reservoir Dam is a rolled earth embankment with vertical concrete core wall. The dam has a straight axis with overall length of about 625 feet, and an embankment height of about 25 feet. The core wall is completely covered by the earthfill. The crest of the dam is 10 feet wide, is paved with asphalt and is used only as a footpath. The upstream and downstream slopes both are 2 horizontal to 1 vertical. The upstream face of the dam is protected by 12 inches of rock riprap.

The original plans for the dam called for the concrete core wall to extend 3 feet into firm rock to form a cutoff. The embankment was to be placed on natural ground after about 2 feet of topsoil had been removed.

The intake structure and raw water supply line to the Haledon Municipal Water Treatment Plant constitutes the outlet works for the reservoir. The intake structure is a reinforced concrete rectangular tower located in the reservoir

at the upstream toe near the right abutment. Four 12-inch diameter pipes through the upstream tower wall provide multi-level inlets to the intake tower. Each of the inlet pipes has a screen on the outside and a control gate in the wet well inside the tower. A concrete block masonry building on top of the concrete structure provides weather protection for the equipment inside the tower. A 16-inch diameter water supply pipeline passes directly under the embankment and connects directly to the water treatment plant. A maximum of 2.5 million gallons per day can be passed through the water treatment plant. There is no bypass or branch outlet on the supply pipeline.

The emergency spillway is an ungated drop inlet and triple conduit under the embankment. The drop inlet is rectangular in plan with the long axis parallel to the dam and outside dimensions of 21 feet 5 inches by 12 feet 8 inches. The rim of the drop inlet is a broad-crested weir 8 inches wide and is 4 feet below the crest of the dam. A concrete trashrack structure surrounds the drop inlet structure to keep out logs. The top of the trashrack is 1 foot above the crest of the drop inlet. The invert of the drop box at the conduit is 9.4 feet below the crest. The conduits discharge, through a reinforced concrete headwall structure, into a short, well-defined natural channel with rocky bottom and wooded slopes. A small lower pond is only about 60 feet from the toe of Haledon Reservoir Dam. The pond is formed by a low dam less than 25 feet high and the pond storage is less than 50 acre-feet.

b. Location

Haledon Reservoir is located in Passaic County, New Jersey, and is accessible by way of High Mountain Road. The dam is on land owned by the Borough of Haledon with private roadway access to the left abutment.

c. Size and Hazard Classification

Haledon Reservoir is classified in the dam size category as being "small", since its storage is less than 1,000 acre-feet and its height is less than 40 feet. Since failure of the dam could cause loss of life and extensive property damage, a hazard potential classification of "high" has been assigned to the project.

d. Ownership

Haledon Reservoir is owned by the Borough of Haledon, 408 Morrissee Avenue, Haledon, New Jersey.

e. Purpose of Dam

Haldeon Reservoir is the source of raw water for the Borough of Haledon water treatment plant, and no other use of the lake or dam is allowed.

f. Design and Construction History

The dam was designed and constructed in 1926. A few drawings and hydraulic calculations prepared at that time by A. W. Cuddeback, for the Borough of Haledon, are available from the New Jersey Department of Environmental Protection. No computations for the design of the embankment or structures

are available for review. It was reported by the owner's representative that the WPA made some improvements in the 1930's, but the details of the improvements were not known to him. The present structure closely resembles the 1926 plans so that the nature of the improvements is not readily apparent.

g. Normal Operational Procedures

The discharge from the reservoir is normally regulated by the water treatment plant to meet its raw water requirements. The policy is to keep as much water as possible in the reservoir. Therefore, the water level varies primarily according to rainfall. The normal variation is only a few feet with occasional drops to 6 or 7 feet. Rarely is the reservoir nearly drained during drought periods such as occurred in 1947.

1.3 Pertinent Data

a. Drainage Area - 1.6 square miles

b. Discharge at Damsite

Maximum known flood at damsite	N.A.
Warm water outlet at pool elevation	N.A.
Diversion tunnel low pool outlet at pool elevation	N.A.
Diversion tunnel outlet at pool elevation	N.A.
Gated spillway capacity at pool elevation	N.A.
Gated spillway capacity at maximum pool elevation	N.A.

Ungated spillway capacity at maximum pool elevation	750 cfs (El. 416.06)
Total spillway capacity at maximum pool elevation	750 cfs

c. Elevation (Feet above MSL)

Top of dam	416.06
Maximum pool-design surcharge	416.06
Full flood control pool	N.A.
Water supply pool	412
Spillway crest	412
Upstream portal invert diversion tunnel	N.A.
Downstream portal invert diversion tunnel	N.A.
Streambed at centerline of dam	20′ ± (Estimated)
Maximum tailwater	N.A.

d. Reservoir

Length of maximum pool	4,000 feet (Estimated)
Length of water supply pool	2,800 feet (Estimated)
Length of flood control pool	N.A.

e. Storage (Acre-Feet)

Water supply pool	657 acre-feet (El. 412)
Flood control pool	N.A.
Design surcharge	823 acre-feet (El. 414.35)
Top of dam	979 acre-feet (El. 416.06)

f. Reservoir Surface (Acres)

Top of dam	99 acres (El. 416.06)
Maximum pool	83 acres (El. 414.35)
Flood control pool	N.A.
Water supply pool	58 acres (El. 412)
Spillway crest	58 acres (El. 412)

g. Dam

Type	Embankment with concrete core wall
Length	625 feet
Height	25 feet
Top width	10 feet
Side slopes	2 horizontal to 1 vertical
Zoning	Core wall with rolled earthfill shells
Impervious core	Core wall
Cutoff	Core wall
Grout curtain	None

h. Diversion and Regulating Tunnel (N.A.)

i. Spillway

Type	Drop inlet and conduits
Conduits	Three 42-inch diameter concrete conduits
Crest elevation	412

Gates	N.A.
Upstream channel	Reservoir
Downstream channel	Well defined channel with some cobble and boulder protection

j. Regulating Outlets

Four 12-inch diameter inlets provided with sluice gates and one 16-inch diameter outlet conduit, located at the right end of the dam. The outlet supplies water to the filter plant and may not be used for the purpose of reservoir drawdown.

SECTION 2: ENGINEERING DATA

2.1 Design

A set of drawings for alternative designs for the dam and spillway structures were available in the files of the New Jersey Department of Environmental Protection. A few hydraulic calculations for the spillway design were available also. The plans for the concrete core wall and earthfill alternative correspond well to the present structures as observed.

2.2 Construction

No records have been found as to the construction history of the dam. The source and quality of the embankment materials is unknown. The plans called for rolled embankment, but the moisture content and compaction equipment used are not known.

2.3 Operation

Records of daily flows through the water treatment plant and reservoir level are kept by the plant operators.

2.4 Evaluation

a. Availability

The availability of engineering data is very poor. The only data available are the drawings pertaining to original alternative plans for the dam and spillway, which can be obtained from the New Jersey Department of Environmental Protection. The "as-built" spillway dimensions are as shown on Plate 4, and not as shown on Plate 3.

b. Adequacy

The available engineering data is not sufficient to perform a comprehensive, definitive stability analysis of the embankment. Data needed to fully assess the stability of the dam includes:

1. Subsurface information at the damsite, including engineering properties and parameters of the bedrock.

2. Soil properties of the embankment.

3. Location of the phreatic line within the dam section at several cross section lines including the maximum section.

4. Verification of, and the vertical extent of the core wall.

A check list of engineering construction and maintenance data is included in Appendex A.

c. Validity

The field inspection appears to substantiate the available plans and sections to the extent that could be determined by visual observations.

SECTION 3: VISUAL INSPECTION

3.1 Findings

a. General

The visual inspection made of Haledon Reservoir Dam did not reveal any signs of distress in the dam or appurtenances. The dam appeared to be in reasonably good condition and adequately maintained.

b. Dam

The embankment appeared to be made up of cohesionless soil. The geometry of the embankment conforms to the 1926 plans with a 2 to 1 downstream slope and a 10 foot wide crest. The upstream slope was below water level at the time of the inspection. The downstream slope was heavily overgrown with brush and trees up to 8 inches in diameter. The upstream slope also supported a growth of brush and weeds near the crest. A paved road, with several longitudinal cracks, lies along the crest, however, the cracks are not believed to be related to movement of the dam. No evidence of vertical or horizontal movement of the dam was detected.

The dam appears to have been raised about 1 foot with granular material. The top 3 to 4 feet of riprap appear hand placed and form a near 1 to 1 slope. Erosion appears to have removed soil from four locations on the crest; the first near the right side of the spillway; the last approximately

100 feet farther right. The areas are semi-circular, 3 to 5 feet in diameter and about 2 to 3 feet deep. Numerous minor riprap failures are apparent near the crest.

Basalt is exposed in the left side of the discharge channel. The basalt is broken into fragments averaging 2 inches in size. The slopes mantling the basalt contain silt, clay and coarse granular material to the size of boulders. The right abutment is made up of red sandstone of the Brunswick Formation.

No flowing seepage was observed on the slope, along the toe or further downstream of the dam. Standing water was observed near the toe of the dam about 50 feet right of the discharge channel. The water table was found to be about 6 inches below ground surface along the toe of the dam, however, this could be attributed to the small impoundment immediately downstream of the dam. Water was observed flowing from the right abutment about 100 feet downstream of the dam, but is not believed related to the dam, rather, may be attributed to ground water runoff from a nearby hillside or an abandoned storm sewer.

c. Appurtenant Structures

1. Spillway

The concrete drop inlet structure and surrounding concrete trashrack are in excellent condition. No evidence of structural cracking or spalling could be found. Most of the joints in the precast concrete pipe conduits are leaking small quantities of clear water all

around the pipe. The joint between the outside of the left conduit and the drop inlet wall was leaking several gallons per minute of clear water.

2. Outlet Works

Only the upper few feet of the concrete intake tower and the covering concrete block building were visible to inspect. The structural concrete and block masonry appears in good condition. The control gates and raw water supply line could not be inspected. The four slide gates located in the outlet gate house are all functional and appear to be well maintained and in very good condition.

d. Reservoir Area

The reservoir rim is gently sloped and no indications of instability were readily apparent. The slopes above the reservoir are heavily wooded. No buildings or dwellings are built on or near the shoreline.

e. Downstream Channel

The downstream channel is well defined, free of vegetation and protected by numerous cobbles and boulders. The side slopes vary from steep to moderate and support trees and brush. Only minor erosion could be observed in a few areas.

3.2 Evaluation

At the time of the inspection the dam did not exhibit any signs of distress. The abutments appeared to be in good condition. Overall, the dam appears to be in good condition. Reservoir slopes show no apparent signs of instability and are not believed a potential hazard to the dam.

SECTION 4: OPERATIONAL PROCEDURES

4.1 Procedures

Because the Haledon Reservoir Dam is used to impound water for the Borough of Haledon water treatment plant, the policy is to maintain as much water as possible in the reservoir. Thus, water is released normally only through the treatment plant. The spillway releases excess flow during storms after the reservoir has been filled.

4.2 Maintenance of the Dam

The dam is under daily surveillance by the water treatment plant personnel. Repairs are made by the Public Works Department of the Borough of Haledon as they deem necessary.

4.3 Maintenance of Operating Facilities

Regular maintenance of the gates, valves and equipment in the intake structure and raw water supply line is performed by the treatment plant operators.

4.4 Evaluation

Maintenance of the facility is in the hands of the Borough of Haledon, Department of Public Works. The procedures are on a simple, as-needed basis. In view of the greater public interest in dam safety, the following procedures should be initiated.

1. An annual visual inspection of the dam utilizing the Corps of Engineers check list conducted by the Borough's engineering representative or the DPW supervisor.

2. Formal daily logging of reservoir levels.

3. Formal logging of maintenance at dam, be it repairs, inspection or reservoir dredging.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design

Haledon Dam is located on the northeast corner of the Borough of North Haledon. The drainage area above the Haledon Dam on the Molly Ann Brook is 1.6 square miles. A drainage map of the watershed of Haledon damsite is presented on Plate 1, Appendix D.

Elevations within the watershed range from approximately 412 feet above mean sea level at the damsite to over 500 feet above mean sea level in the upper portion of the watershed.

Land use patterns within the watershed are mostly urban with some forested lands in the areas near the reservoir. Most of the urban areas are located along the main streets and highways.

The evaulation of the hydraulic and hydrologic features of Haledon Dam was based on criteria set forth in the Corps guidelines and additional guidance provided by the Philadelphia District, Corps of Engineers. The Probable Maximum Flood (PMF) was calculated from the Probable Maximum Precipitation using Hydrometeorological Report No. 33 with standard reduction factors. Due to the small drainage area of Haledon Dam, the SCS triangular hydrograph, transformed to a curvilinear hydrograph, was adopted for developing the unit hydrograph. The derived unit hydrograph is presented in Appendix D.

Initial and infiltration loss rates were applied using SCS procedure to the Probable Maximum Storm rainfall to obtain rainfall excesses. The rainfall excesses were then applied to the unit hydrograph to obtain the PMF hydrograph utilizing program HEC-1.

The computed peak discharges of PMF and one-half the PMF are 7,920 cfs and 3,960 cfs, respectively.

Both the PMF and one-half the PMF inflow hydrographs were routed through the reservoir by the Modified Puls Method, also utilizing computer program HEC-1. The peak outflow discharges for the PMF and one-half the PMF are 6,478 cfs and 2,054 cfs, respectively. Both the PMF and one-half the PMF result in overtopping of the dam.

The stage-outflow relation for the spillway was prepared from field notes, sketches and limited construction drawings. The reservoir stage-capacity data were based on the U.S.G.S. quadrangle topographic maps in combination with data given in the National Dam Safety Inventory Table. Reservoir storage capacity include for surcharge levels exceeding the top of the dam and the spillway rating curve assumed that the dam remains intact during routing. In the routing computations, the discharge through outlet facilities was excluded due to its insignificant magnitude as compared to the spillway discharge and the PMF. The spillway rating curve and the reservoir capacity curve are presented in Plates 2 and 3 of Appendix D, respectively.

b. Experience Data

No records of reservoir stage or spillway discharge are maintained for this site. However, according to the owner of the dam, the maximum reservoir level was never higher than the crest of the embankment.

c. Visual Observation

The spillway structure and the approach channel are well defined. No new urbanization was noted in the reservoir area. The downstream channel is also well defined with heavy riprap along river banks, but with thick tree growth.

d. Overtopping Potential

As indicated in Section 5.1-a., both the Probable Maximum Flood and one-half the Probable Maximum Flood, when routed through Haledon Lake Reservoir result in overtopping the dam. The spillway and reservoir surcharge capacities are too small to accommodate the peak flows. The PMF and one-half the PMF overtopped the dam by 2.09 feet and 0.54 feet, respectively. The spillway is only capable of passing a flood equal to approximately thirty-five percent of the PMF without overtopping the dam. Since one-half the PMF is the minimum Spillway Design Flood (SDF) for this dam, according to the Recommended Guidelines for Safety Inspection of Dams by the Corps of Engineers, the spillway capacity of the Haledon Dam is considered "Inadequate".

SECTION 6: STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

There are no signs of embankment sloughing, rock slides or slumps on the downstream side. The upstream side of the embankment was almost completely under water and was not accessible for visual inspection. Some erosion, as described in Section 3.1b, was observed near the crest on the upstream side.

Neither the spillway drop inlet nor the discharge headwall exhibited any evidence of undermining or misalignment.

b. Design and Construction Data

No design computations were uncovered during the report preparation phase. No embankment or foundation soil parameters are available for carrying out a conventional stability analysis on the embankment. No construction data or specifications relating to the degree of embankment compaction are available for use in the stability analysis.

c. Operating Records

No operating records are available relating to the stability of the dam.

d. Post-Construction Changes

There are no records of post-construction changes. It was orally reported that improvements were made to the dam in the 1930's by the W.P.A., but the exact nature of the work was unknown.

From the visual inspection it appeared that the dam crest was raised about 1 foot with granular material.

e. Static Stability

A static stability analysis was performed on a section, as defined in the 1926 Plan, titled Borough of Haledon Water Improvements, to better assess the adequacy of the structure. Bishops method of slices was used with assumed parameters for the embankment and foundation materials. The phreatic surface was taken at normal water surface elevation upstream and assumed horizontal at ground elevation from the downstream toe back to the core wall. No failure circles were passed through the core wall. The validity of the results are, of course, a function of the assumptions made. The results, which are given in Appendix E, did yield an acceptable factor of safety for both the deep and shallow failure arcs analyzed. The following parameters were assumed:

Fill Material and Foundation

Friction Angle = 30^{o}

Moist Unit Weight = 125 p.c.f.

Saturated Unit Weight = 130 p.c.f.

Several faults, mapped by others, occur west of the dam, the closest being about 2,500 feet. The dam is located in Seismic Zone 1, as defined in Recommended Guidelines For Safety Inspection of Dams as prepared by the Corps of Engineers. In general, projects located in Seismic Zones 0, 1 and 2 may be assumed to present no hazard from earthquake, provided the static stability conditions are satisfactory and conventional safety margins exist.

SECTION 7: ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment

a. Safety

The dam has been inspected visually and a review has been made of the available engineering data. This assessment is subject to the limitation inherent in the visual inspection procedures stipulated by the Corps of Engineers for a Phase I report.

The safety of Haledon Reservoir Dam is in question because the dam does not have an adequate spillway capacity to pass the PMF or even one-half of the PMF without overtopping. Overtopping of the dam carries with it the danger of possible progressive failure of the embankment. The dam's present spillway capacity can pass only about 35 percent of the PMF.

No definitive statement pertaining to the safety of the embankment can be made without acquisition of embankment and foundation material engineering properties and determination of phreatic levels in the downstream part of the embankment. The present embankment, however, has performed adequately since its construction in 1926 without failure or evidence of instability. The stability analysis, with its limitations, does not reveal potential for serious slope failure. The possibility of minor sloughing may exist, particularly in the event of seismic excitation.

The leakages into and around the spillway conduits should be stopped to prevent possible loss of fines from embankment material.

b. Adequacy of Information

The information and data uncovered is not adequate to perform a comprehensive, definitive evaluation of the dam's stability. Nevertheless, in view of the past performance of the dam, its present condition, and in light of the stability calculations performed, it is not felt that additional information on the engineering properties of the embankment and foundation materials is necessary at this time.

c. Urgency

Studies to augment the spillway discharge capacity should be undertaken within six months.

The repairs to stop spillway conduit leakages should be undertaken within three months.

7.2 Remedial Measures

a. Alternatives

The alternative available for increasing the spillway capacity are:

1. Increasing the dam height, thus permitting a higher discharge to pass through the spillway without overtopping.

2. Enlarging the existing spillway to accomodate a flood peak of at least one-half the PMF.

3. A combinatiom of any of the above alternatives.

The conduit leakages can be stopped best by pressure grouting in the earth embankment behind the joints through holes drilled in the concrete.

7.3 Recommendations

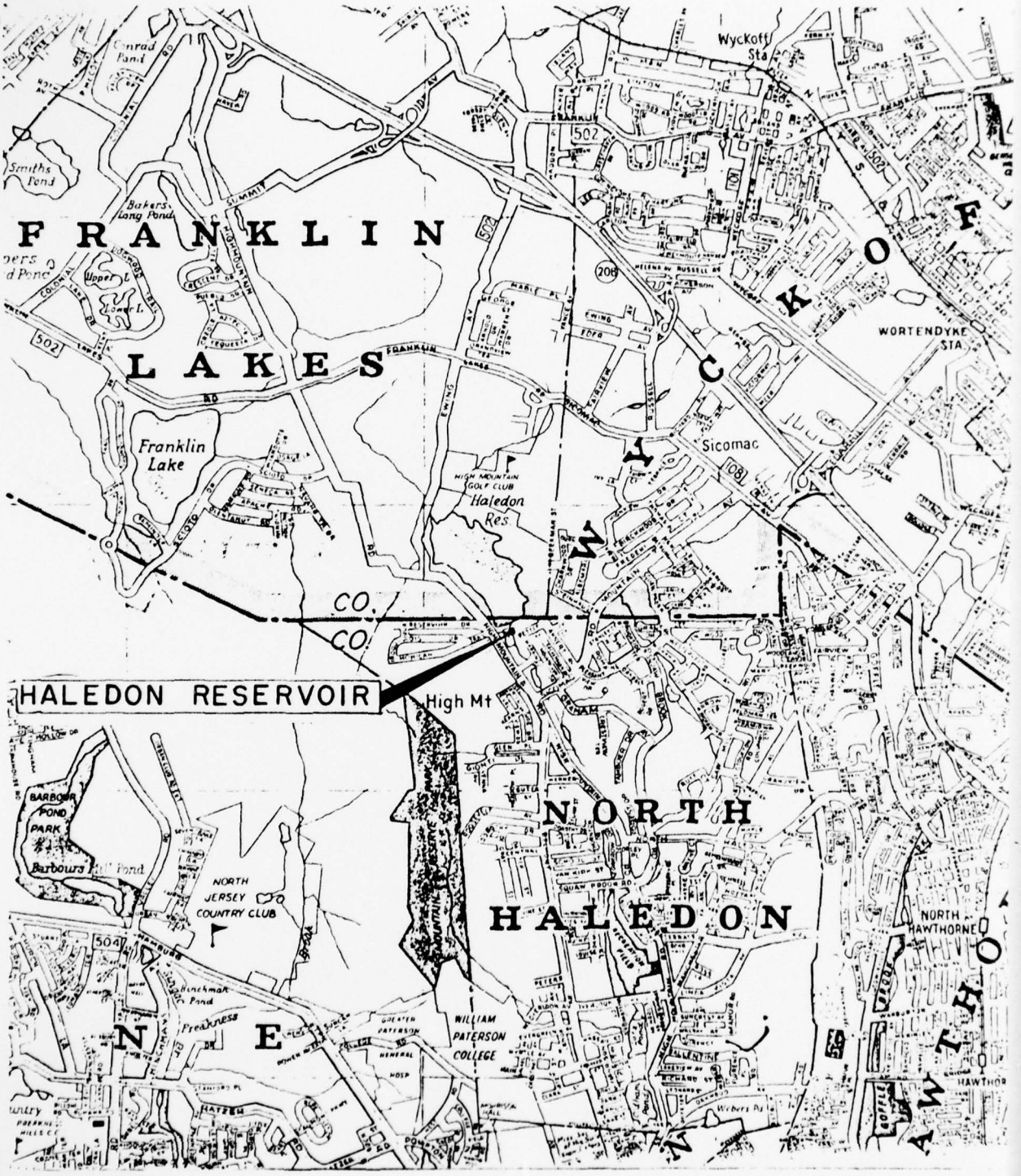
Based on the visual inspection and data evaluation presented herein, the following action is recommended.

1. All brush and trees should be removed from the downstream slope to avoid problems which may develop from their roots. The embankment should then be seeded to develop a growth of grass for surface erosion protection.

2. O & M Procedures: The owner should initiate a program of annual inspections of Haledon Reservoir Dam, and the small storage pond dam utilizing the standard visual check list in this report. Headwater and tailwater gages should be installed in the dam, and read out during severe rainstorms and at routine operating and maintenance visits to the dam. A program should be developed to monitor possible seepage through the embankment. A permanent log should be kept of all maintenance and operating events of the dam, lake and outlet passages.

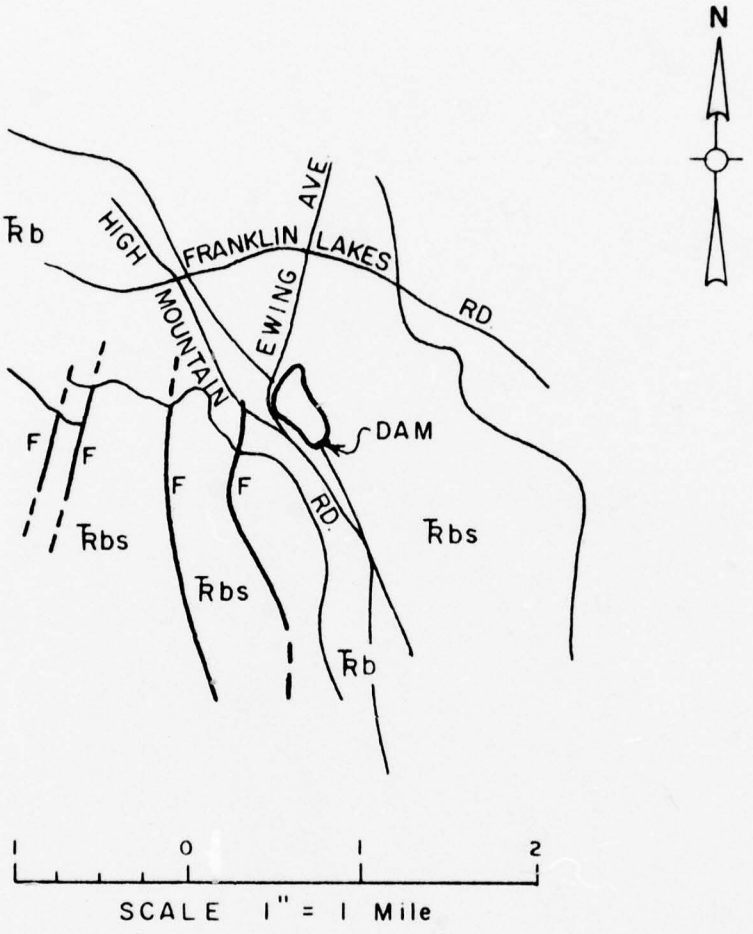
3. The erosion which has occured on the upstream crest of the embankment should be repaired. An effective method of protecting the crest from future erosion should be implemented.

PLATES



VICINITY MAP

PLATE 1

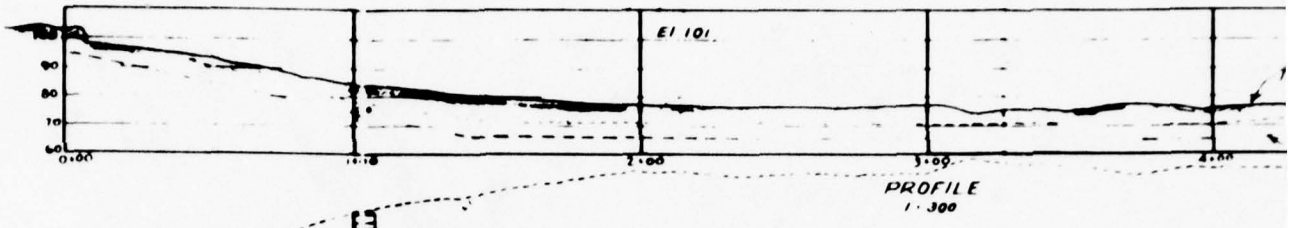


LEGEND

Trb	BRUNSWICK FORMATION RED SANDSTONE WITH INTERBEDS OF SOFT, RED SHALE
Trbs	BASALT
F	FAULT

GEOLOGIC MAP
HALEDON DAM

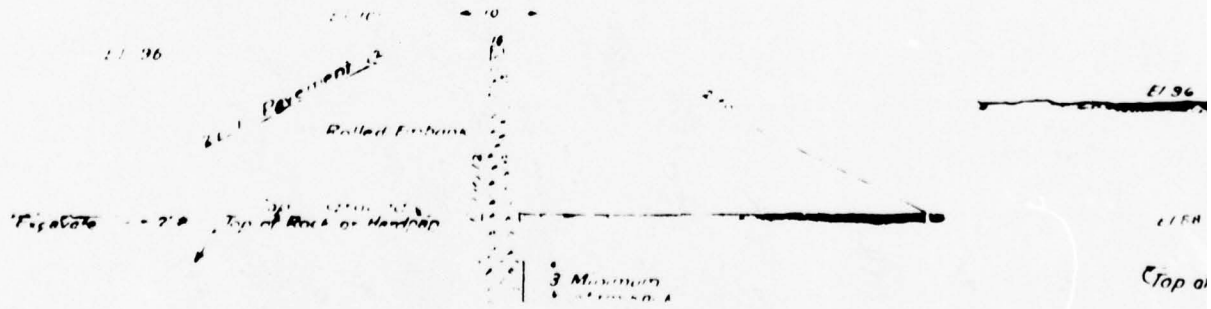
PLATE 2



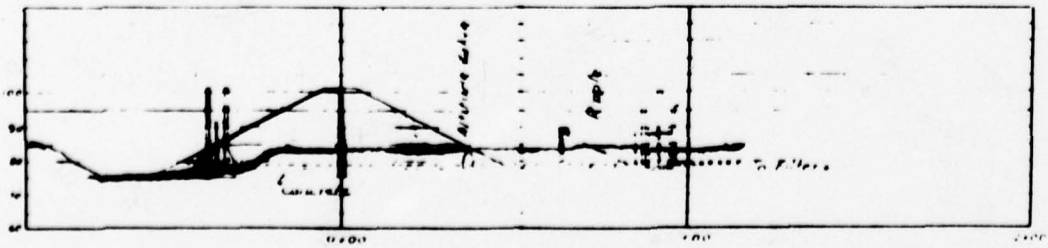
PROFILE
1" = 300'

To be excavated to a depth of 2'-0"

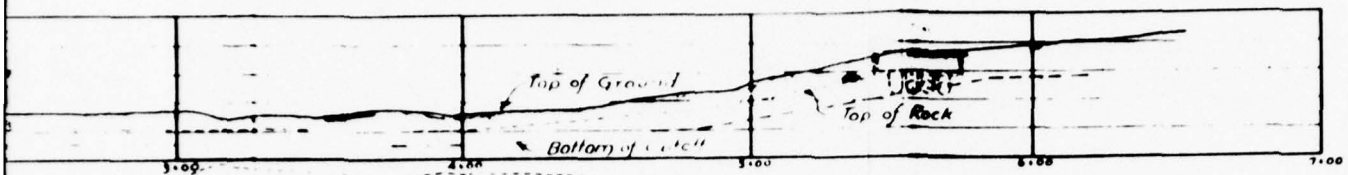
PLAN
1" = 300'



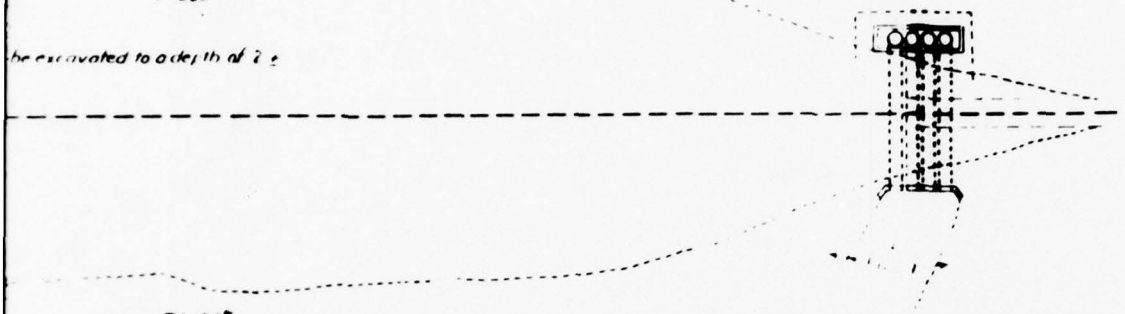
SECTION A A OF DAM
Scale 1" = 10'



SECTION THRU INTAKE STRUCTURE

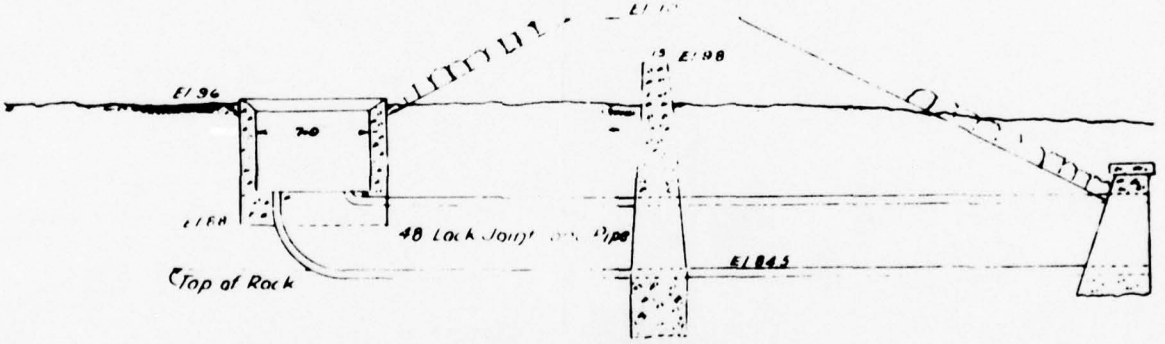


PROFILE
1" = 300'



PLAN
1" = 300'

NOTE: 4 conduits are shown but only 3 conduits were constructed as shown on the following drawing.



SECTION THRU SPILLWAY
Scale 3/16" = 1'0"

BOROUGH OF HALEDON

WATER WORKS IMPROVMENTS

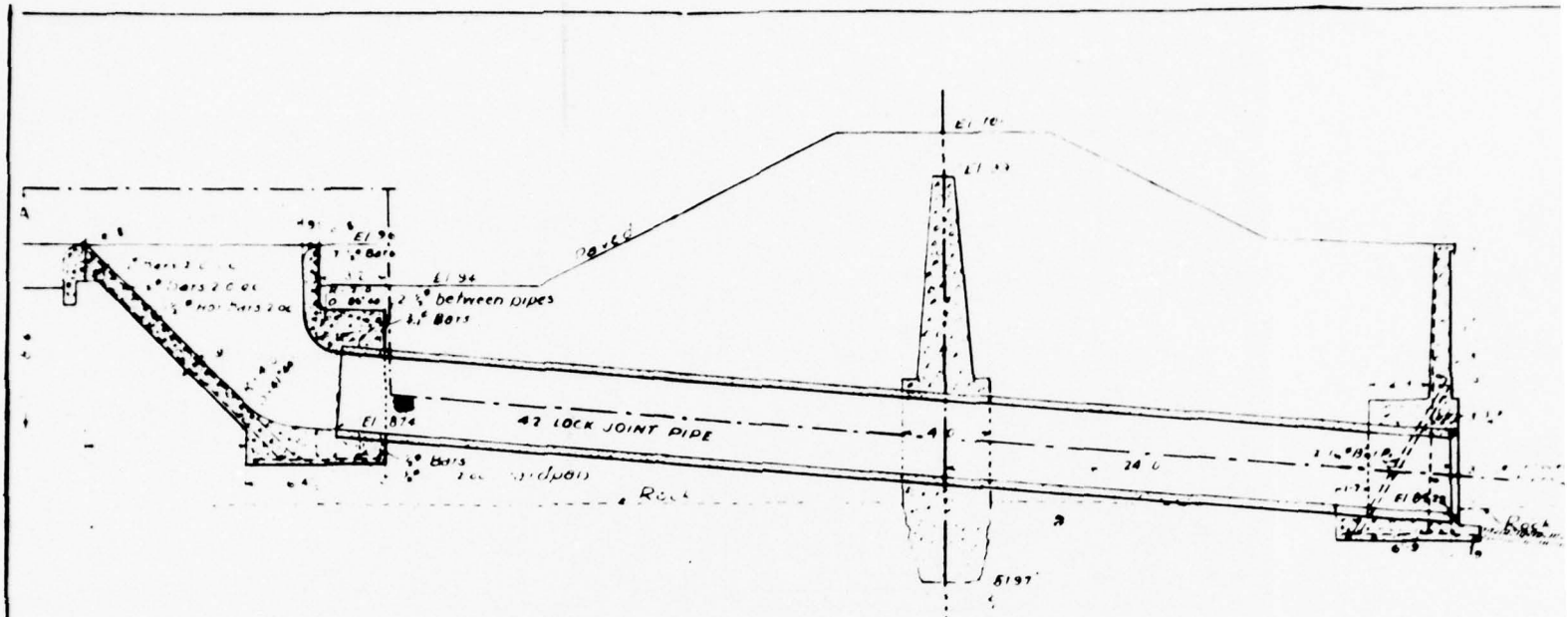
GENERAL LAYOUT FOR EARTH DAM

Scales as noted March 1-1926

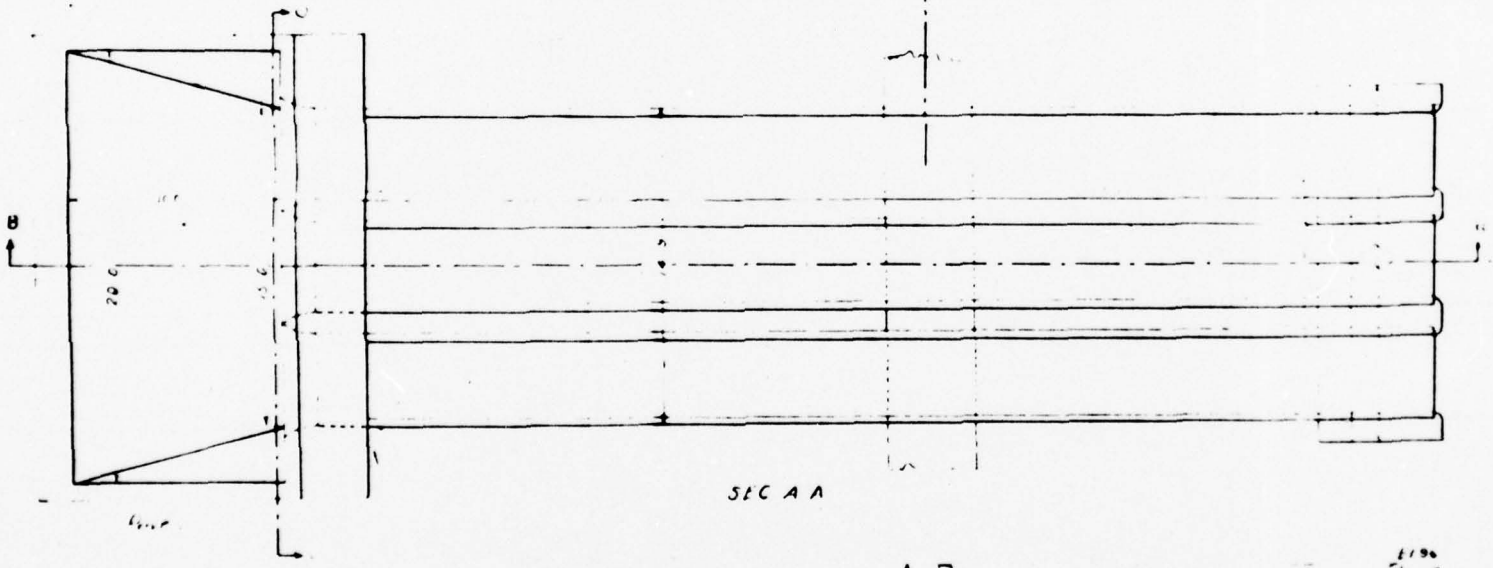
A W Middleback
Engineer

SHEET NO

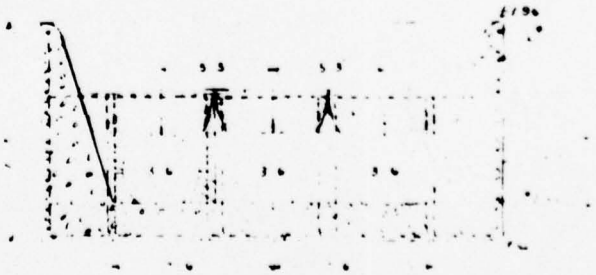
PLATE 3



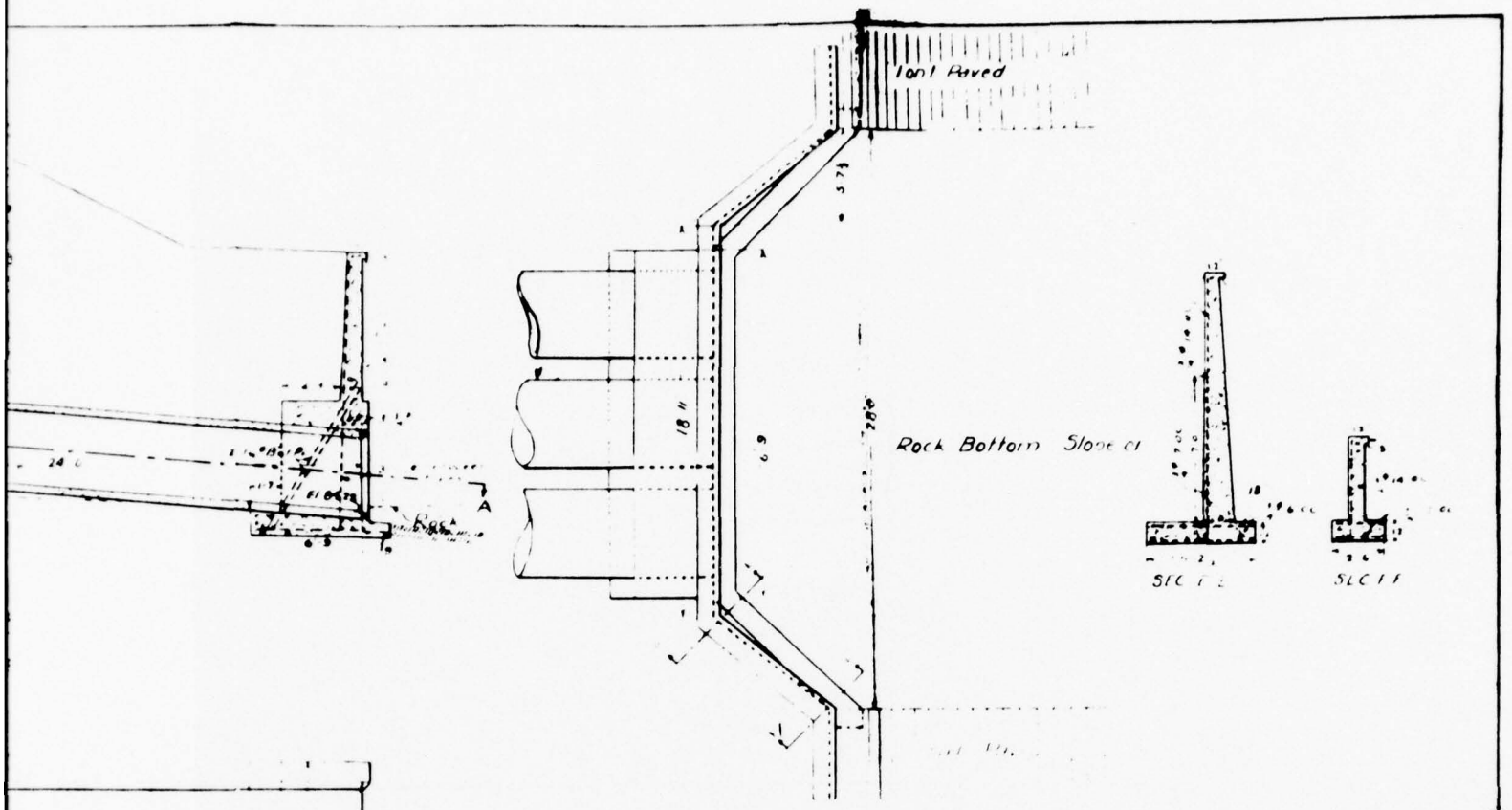
SEC B-B

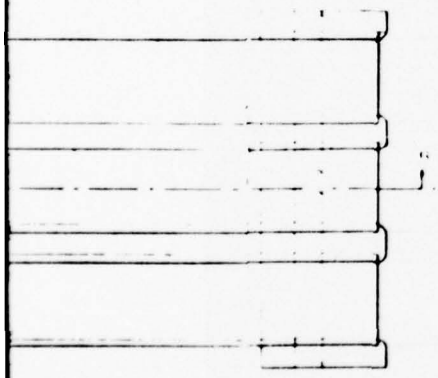


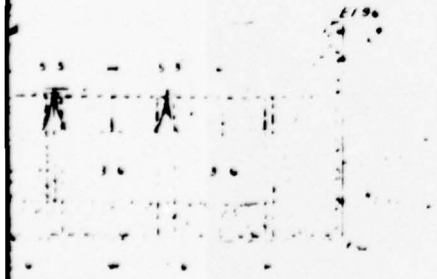
SEC A-A



SIDE ELEV INTAKE







ELEV OUTLET

BOROUGH OF HALEDON

WATER WORKS IMPROVMENTS

SPILLWAY DETAILS

Scale 1"=1' Aug 3 1926

PLATE 4

APPENDIX A

CHECK LIST - VISUAL OBSERVATIONS

CHECK LIST - ENGINEERING, CONSTRUCTION MAINTENANCE DATA

CHECK LIST

Visual Inspection
Phase I

Name Dam Haledon Reservoir County Passaic State New Jersey Coordinators _____

Date(s) Inspection June 29, 1978 Weather Clear-Warm Temperature 75°F

Pool Elevation at Time of Inspection _____ M.S.L. Tailwater at Time of Inspection _____ M.S.L.

Inspection Personnel:

(June 29, 1978)	(June 29, 1978)	(July 7, 1978)
Joe Sirianni	William Flynn	Yin Au-Yeung
Henry King		Lynn Brown
David Kerkes		

Robert B. Campbell Recorder

Owner Representative:

(June 29, 1978)

Fred Peloso, Superintendent Public Works
Borough of Haledon

CONCRETE/MASONRY DAMS

Haledon Reservoir

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SEEPAGE OR LEAKAGE	N.A. (Not Applicable)	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	N.A.	
DRAINS	N.A.	
WATER PASSAGES	N.A.	
FOUNDATION		

CONCRETE/MASONRY DAMS

Haledon Reservoir

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	N.A.	
STRUCTURAL CRACKING	N.A.	
VERTICAL AND HORIZONTAL ALIGNMENT	N.A.	
MONOLITH JOINTS	N.A.	
CONSTRUCTION JOINTS	N.A.	

EMBANKMENT

Haledon Reservoir

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	Crest covered with asphalt paving having several major longitudinal cracks not believed related to movement of dam. One small hole found which might have been made by snake or animal burrowing in embankment. Embankment heavily covered with brush and vines.	Remove brush and vines from slope and toe of embankment. Annual inspection for burrowing animals and snakes, and trap or poison if found.
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	No surficial evidence of movement or cracking at or beyond toe.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Crest appears to have been raised about 1 foot with gravelly soil. Four small erosions at upstream crest 3 to 5 feet diameter, semi-circular and 2-3 feet deep located from right side of spillway to 100 feet right of spillway. Minor riprap failures at these locations. No sloughing or erosion of abutment slopes found.	Repair riprap failures and backfill erosions. Repair asphalt paving on crest.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	No evidence of movement found.	Establish horizontal and vertical alignment survey monuments on both slopes near crest. Annually run survey to detect changes.
RIPRAP FAILURES	Top 3 to 4 feet or riprap appears hand placed forming 1:1 sloping soil packed rubble wall. Riprap below maximum water surface is loose. Minor riprap failures at numerous locations along embankment, especially near crest.	Repair all riprap failures.

EMBANKMENT

Haledon Reservoir

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
TREES	Large trees with 6 to 8 inch diameter trunks growing on downstream slope of embankment.	Trees should be cut and downstream slope kept clear of trees to prevent large root systems from penetrating embankment.
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Both abutments look good. No evidence of erosion can be found.	
ANY NOTICEABLE SEEPAGE	Some wet and/or seep areas noticed along toe but no flowing water could be found. Standing water found in one place approximately 50 feet right of spillway outlet.	Inspect area below dam monthly to detect changes in wet areas.
STAFF AND GAGE RECORDER	None at time of inspection.	Reinstall staff gage.
DRAINS	None.	

OUTLET WORKS

Haledon Reservoir

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Concrete tower structure is in good shape.	
INTAKE STRUCTURE	Concrete rectangular tower with four 12-inch diameter multi-level pipes through tower wall. Pipes have trash bars across front. Outlet from tower is through 12-inch diameter discharge pipe.	
OUTLET STRUCTURE	None - 16 inch discharge pipeline connects directly to water treatment plant.	
OUTLET CHANNEL	None.	
EMERGENCY GATE	None - Only low-level outlet is through the treatment plant. There is no bypass around treatment plant. 2-1/2 MGD maximum can be passed through the plant. Clarifier has overflow but capacity is not known.	Valves and bypass line should be installed to enable draw-down of reservoir without having to go through treat-ment plant.

UNGATED SPILLWAY

Haledon Reservoir

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Rectangular perimeter overflow wier wall with 8" wide flat top. Concrete surfaces in excellent condition. No structural cracks visible. Outer concrete trash rack structure installed about 8 years ago. Spillway is drop inlet type. Spillway discharge is carried through three conduits.	Minor seeps through joints around drop structure can be seen. No repair believed required.
APPROACH CHANNEL	None - Spillway inlet is out in the reservoir with approach from all around.	
DISCHARGE CHANNEL	Outlet of conduits is out of concrete headwall structure. Concrete headwall is in excellent condition. Downstream channel is a natural, rocky channel with gentle sideslopes.	
BRIDGE AND PIERS	None.	
CONCRETE PIPE CONDUITS	Three concrete pipe conduits carry spillway flow under embankment. All pipes are leaking through joints near axis of dam between 2-5 gpm. Large leak of about 20 gpm flow into drop structure around the left pipe. All flows are clear water. Concrete surfaces of pipe are in good condition.	Leakages around left pipe into drop structure into pipes at joints should be stopped.

GATED SPILLWAY

(None)

Haledon Reservoir

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	N.A.	
APPROACH CHANNEL	N.A.	
DISCHARGE CHANNEL	N.A.	
BRIDGE AND PIERS	N.A.	
GATES AND OPERATION EQUIPMENT	N.A.	

INSTRUMENTATION

Haledon Reservoir

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None	
OBSERVATION WELLS	None	
WEIRS	None	
PIEZOMETERS	None	
OTHER	None	

RESERVOIR

Haledon Reservoir

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Gently sloping away from lake. Slopes are heavily wooded and appear stable.	
SEDIMENTATION	No significant evidence of sediment found but some sedimentation reported by water superintendent. The Department of Public Works is contemplating agreeing to allow a developer to excavate sediment within reservoir for use as fill material.	
SHORELINE STRUCTURES	No dwellings on or near shorelines. Department of Public Works, Borough of Haledon owns 100 feet around lake shore.	
USE	Reservoir is raw water storage for the municipal water system for the Borough of Haledon.	
OPERATION	Normal variation is only a few feet with occasional drop to 6 or 7 feet. Level varies according to rainfall. Lake was virtually drained in 1947 drought. Reservoir is about 14 feet deep.	

DOWNSTREAM CHANNEL

Haledon Reservoir

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Very short channel to small lower lake. Well defined natural channel. Wooded slopes with rocky bottom. The lower lake is only about 60 feet from the toe of Haledon Dam.	
SLOPES	Sideslopes very gentle and heavily wooded.	
APPROXIMATE NUMBER OF HOMES AND POPULATION	None - Water treatment plant is beyond lower site.	

CHECK LIST
ENGINEERING DATA

DESIGN, CONSTRUCTION, OPERATION

Haledon Reservoir

ITEM	REMARKS
PLAN OF DAM	Original construction plan is available.
REGIONAL VICINITY MAP	Available.
CONSTRUCTION HISTORY	Original construction history not available.
TYPICAL SECTIONS OF DAM	Available on plans listed above.
HYDROLOGIC/HYDRAULIC DATA	None available.
OUTLETS - PLAN	) None Available.
- DETAILS	) None Available.
- CONSTRAINTS	) Maximum discharge through treatment plant - 2.5 mgd.
- DISCHARGE RATINGS	) None Available.
RAINFALL/RESERVOIR RECORDS	None Available.

CHECK LIST
ENGINEERING DATA

DESIGN, CONSTRUCTION, OPERATION
(Continued)

Haledon Reservoir

ITEM	REMARKS
DESIGN REPORTS	None available.
GEOLOGY REPORTS	None available.
DESIGN COMPUTATIONS	None Available.
HYDROLOGY & HYDRAULICS	Available for the spillway conduits but not to "present-day" standards.
DAM STABILITY	None Available.
SEEPAGE STUDIES	None Available.
MATERIALS INVESTIGATIONS	
BORING RECORDS	None available.
LABORATORY	
FIELD	
POST-CONSTRUCTION SURVEYS OF DAM	None Available.
BORROW SOURCES	Unknown. Appear to be from local sources.
SPILLWAY - PLAN	
- SECTIONS	None available for existing spillway.
- DETAILS	

CHECK LIST
ENGINEERING DATA

DESIGN, CONSTRUCTION, OPERATION
(Continued)

Haledon Reservoir

ITEM	REMARKS
OPERATING EQUIPMENT PLANS AND DETAILS	None available.
MONITORING SYSTEMS	None available.
MODIFICATIONS	Unknown.
HIGH POOL RECORDS	None available.
POST-CONSTRUCTION ENGINEERING STUDIES AND REPORTS	Dam inspected and report prepared by State of New Jersey in 1961.
PRIOR ACCIDENTS OR FAILURE OF DAM - DESCRIPTION - REPORTS	None Reported.
MAINTENANCE, OPERATION RECORDS	Daily flow records through treatment plant.

APPENDIX B

PHOTOGRAPHS

(All photos were taken on June 29, 1978.)

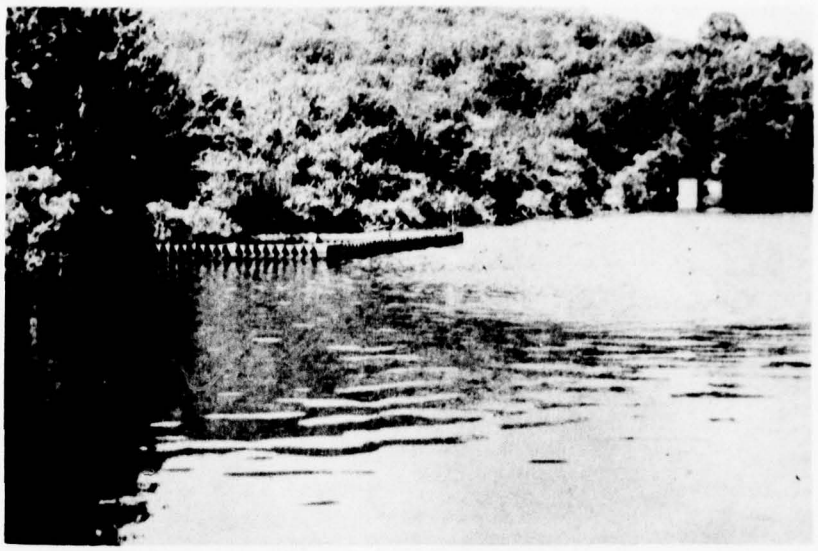


Photo 1 - View of dam from upstream left shoreline.

Photo 2 - View of crest of dam from left abutment.

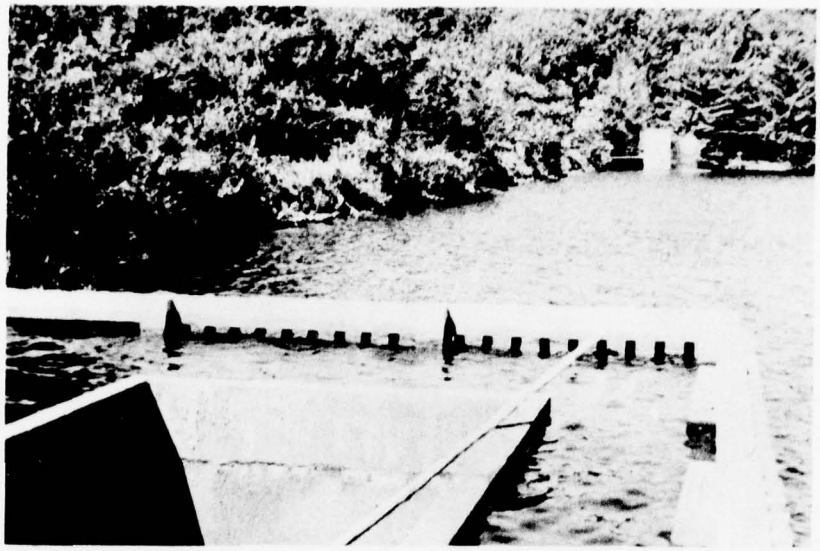


Photo 3 - Upstream slope of dam showing brush and vine overgrowth. Note thin log which is stuck in inlet.

Photo 4 - View of downstream slope of dam showing heavy brush and timber growth on embankment.

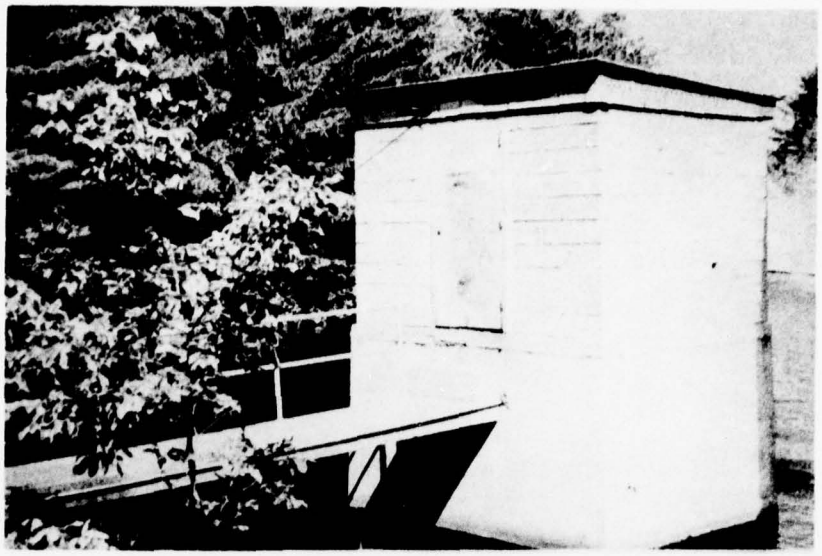


Photo 5 - Intake gate house for water supply to treatment plant.

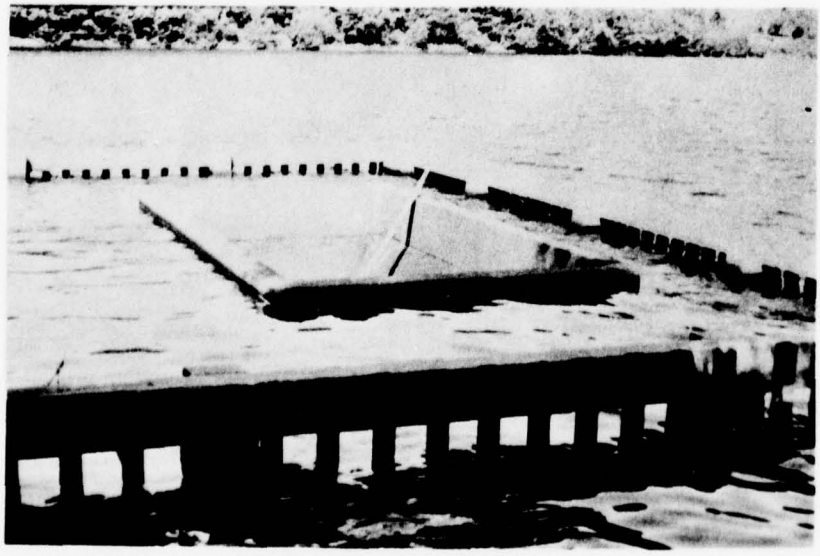


Photo 6 - Rectangular drop-inlet spillway intake and concrete trash guard.

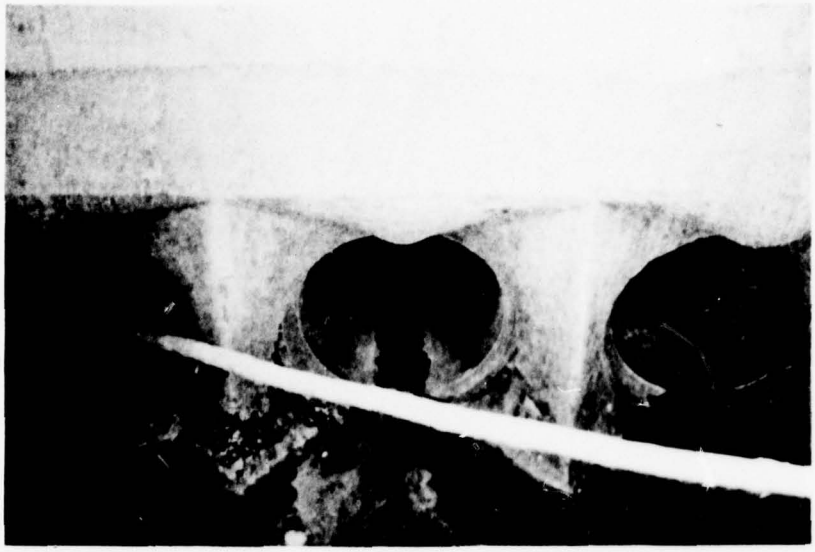


Photo 7 - Three 42-inch diameter concrete pipe conduits in spillway drop-inlet structure. Note thin log resting across outlets.

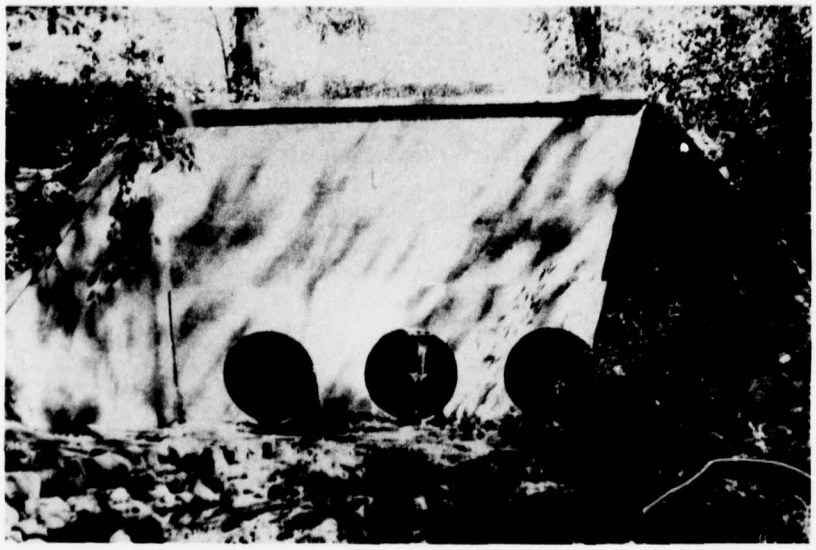


Photo 8 - View of spillway outlet conduits and headwall.

Photo 9 - Discharge channel from spillway outlet.

Photo 10 - Downstream channel to lower impoundment.

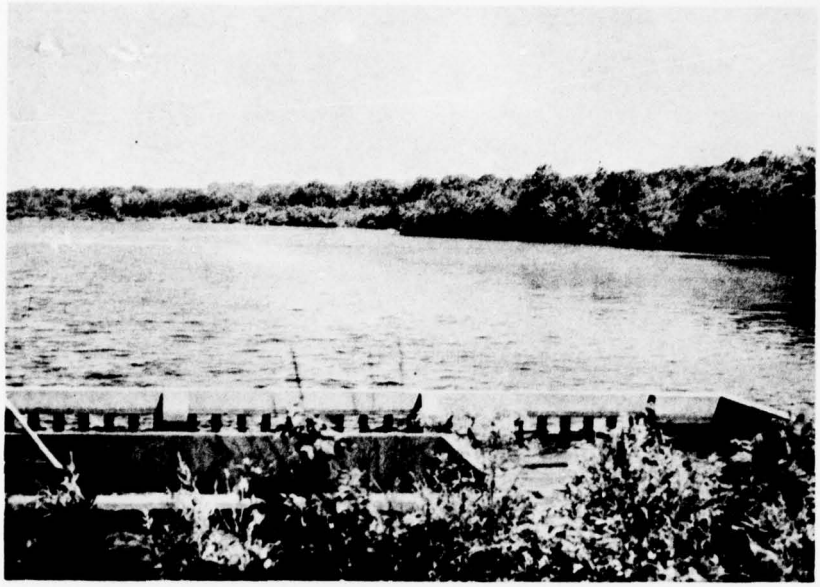


Photo 11 - Haledon Reservoir and left shoreline.

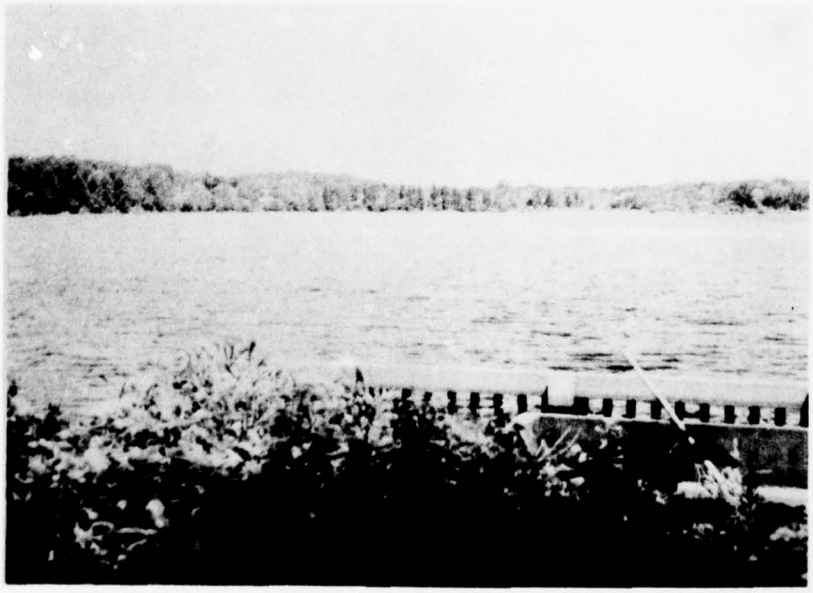


Photo 12 - Haledon Reservoir and right shoreline.

APPENDIX C

SUMMARY OF ENGINEERING DATA

CHECK LIST

HYDROLOGIC AND HYDRAULIC DATA

ENGINEERING DATA

Name of Dam: Haledon Reservoir Dam

Drainage Area: 1.6 square miles

Elevation Top Normal Pool (Storage Capacity): 412. (657 AF)

Elevation Top Flood Control Pool (Storage Capacity): Not applicable

Elevation Maximum Design Pool: 414.35

Elevation Top of Dam: 416.06

SPILLWAY CREST:

a. Elevation: 412

b. Type: Drop Inlet Spillway

c. Width: Not applicable

d. Length: Three 42 inch conduits

e. Location Spillover: Left end of the dam

f. Number and Type of Gates: None

OUTLET WORKS:

a. Type: Four 12-inch dia. inlets provided w/sluice gates and one 16-inch dia. conduit outlet

b. Location: Right end of the dam

c. Entrance Inverts: 406.82 (upper 2-12"); 398.75 (lower 2-12"); 391.73 (16" main)

d. Exit Inverts: Not applicable

e. Emergency Draindown Facilities: None (the outlet supplies water to filter plant)

HYDROMETEOROLOGICAL GAGES: (None)

a. Type:

b. Location:

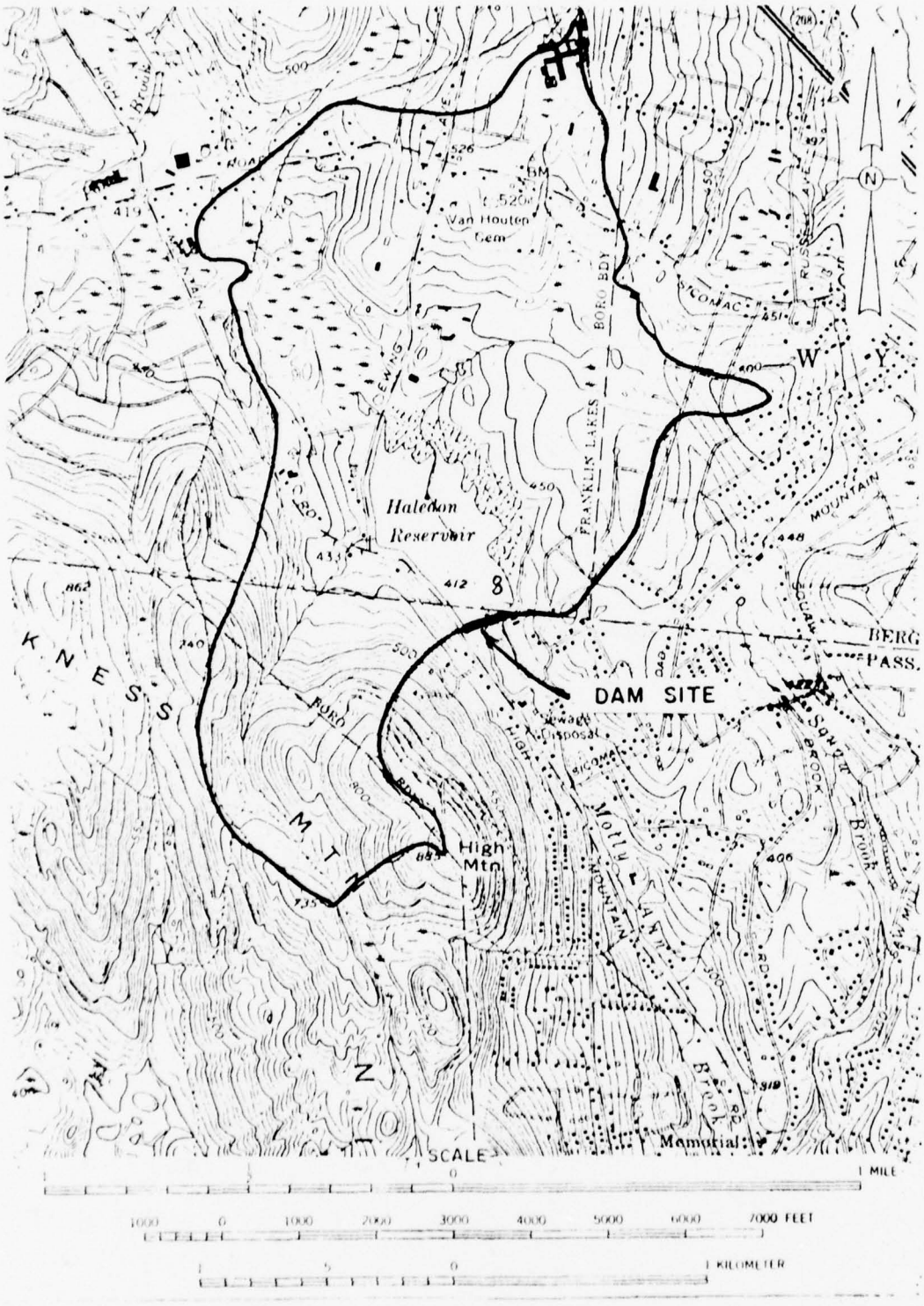
c. Records:

MAXIMUM NON-DAMAGING DISCHARGE: 750 cfs (Estimated)

APPENDIX D

HYDROLOGIC COMPUTATIONS

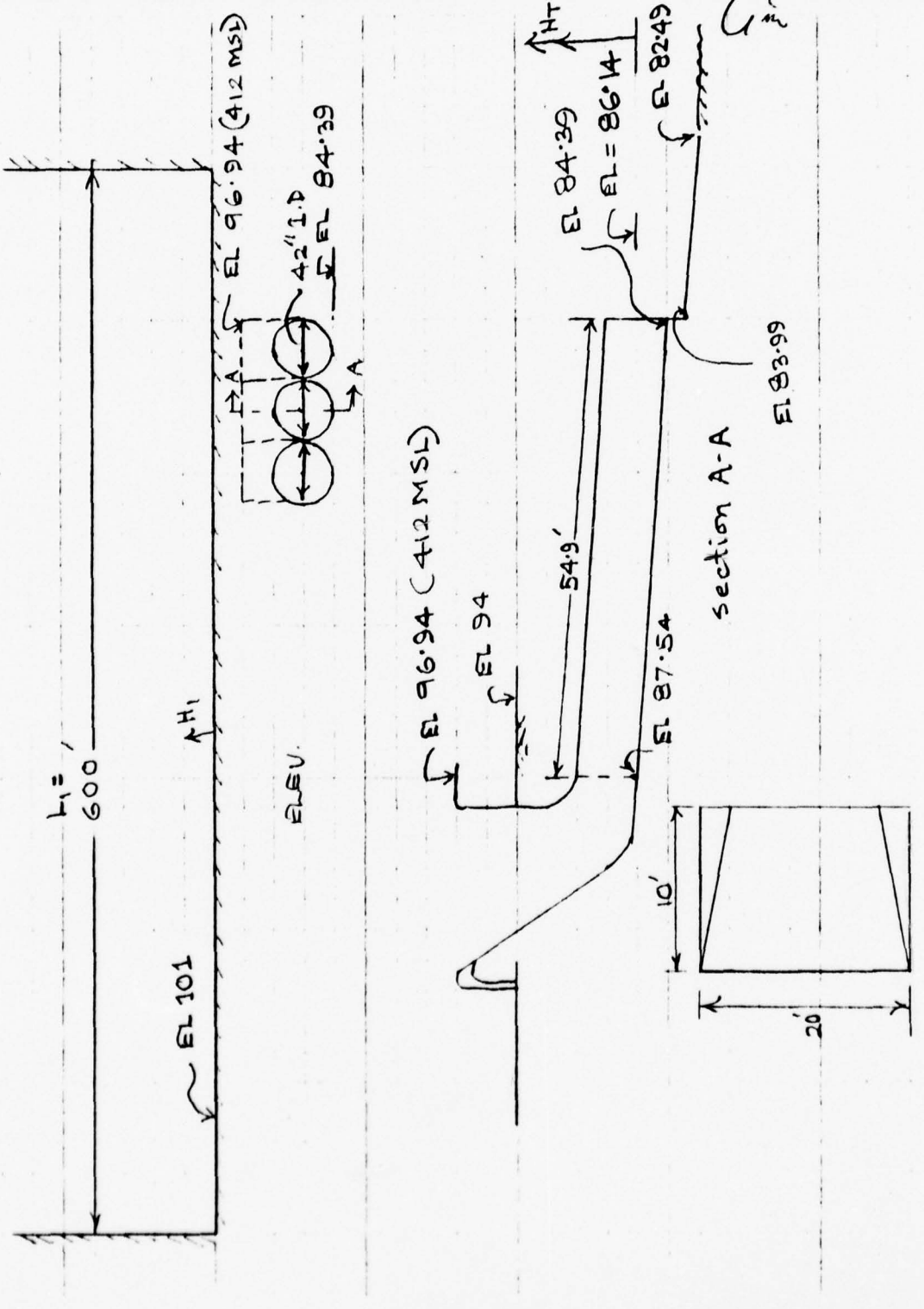
PLATE 1, APPENDIX-D



HALEDON RESERVOIR DAM
DRAINAGE MAP

ECI-4 ENGINEERING CONSULTANTS, INC.

NEW JERSEY (STATE) DAM SAFETY INSPECTION SHEET NO. 1 OF 7
HALEDON RESERVOIR DAM JOB NO. 1212-001
SPILLWAY & OVERTOP RATING CURVE BY JMAG DATE 8-3-81



SPILLWAY DISCHARGES (Assuming no tailwater effect)

W.L at EL 98 (413.06 MSL)

a) Weir flow:

Assume $C = 3.03$

$\therefore Q = CLH^{1.5} = 3.03 \times 60 \times 1.06^{1.5}$

$= 198$ cfs.

b) Permissible flow through the pipe

Slope of pipe = $S = \frac{3.15}{\sqrt{54.9^2 - 3.15^2}}$

$S = \frac{3.15}{54.81} = \underline{0.0575}$

Critical Slope:

$Q = \frac{198}{3} = 66$ cfs.

$Z = \frac{Q}{\sqrt{g}} = \frac{66}{\sqrt{32.2}} = 11.63$

$\frac{Z}{d_o^{2.5}} = \frac{11.63}{3.5^{2.5}} = 0.51$

for $\frac{Z}{d_o^{2.5}} = 0.51$, $\frac{y_c}{d_o} = 0.73 \Rightarrow y_c = 2.56'$

$\therefore S_c = \left(\frac{Qn}{1.49 A R^{2/3}}\right)^2$

Assume $n = 0.013$

$$\frac{y_c}{d_o} = 0.73 \Rightarrow \frac{A}{A_o} = 0.79 \;\&\; \frac{R}{R_o} = 1.2$$

where $A_o = 0.7854 d_o^2 = 0.7854 \times 3.5^2$

$= 9.62$ ft²

$R_o = 0.25 d_o = 0.25 \times 3.5 = 0.88$'

$\therefore A = 0.79 \times 9.62 = 7.6$ ft²

$R = 1.2 \times 0.88 = 1.06$ ft

$$\therefore S_c = \left(\frac{66 \times .013}{1.49 \times 7.6 \times 1.06^{2/3}}\right)^2$$

$= 0.0053 << S$

Pipe Slope is Supercritical

Critical depth may occur at the inlet to the pipe and the flow through the pipe may be supercritical flow

$\therefore$ **$Q_{sp} = 198$ cfs**

W.L. at EL 99.3 (414.06 MSL)

a) Weir flow:

$$Q = 3.03 \times 60 \times 2.06^{1.5}$$
$$= 538 \text{ cfs}$$

b) Permissible discharge through the pipe:

$$Q = \frac{538}{3} = 179 \text{ cfs}$$

$$Z = \frac{Q}{\sqrt{g}} = \frac{179}{\sqrt{32.2}} = 31.54$$

$$\frac{Z}{d_o^{2.5}} = \frac{31.54}{3.5^{2.5}} = 1.38 \Rightarrow \frac{Y_c}{d_o} = 0.98$$

$$\Rightarrow Y_c = 3.43'$$

$$\frac{Y_c}{d_o} = 0.98 \Rightarrow \frac{A}{A_o} = 0.99$$

$$\& \quad \frac{R}{R_o} = 1.05$$

$$\therefore A = 0.99 \times \frac{\pi}{4} \times (3.5)^2 = 9.52 \text{ ft}^2$$

$$R = \frac{1}{4}(3.5) \times 1.05 = 0.92$$

$$S_c = \left(\frac{179 \times .013}{1.49 \times 9.52 \times 0.92^{0.67}}\right)^2 = 0.0301 < S = .0575$$

As the critical depth is $< d_o$, and the inlet is rounded check for pressure flow.

Pressure flow:

$$H_T = \left(1 + K_e + f\frac{L}{D}\right)\frac{V^2}{2g}$$

Assume $K_e = 0.10$;

& $f = .021$ for $n = .013$

$$\therefore H_T = \left(1 + .10 + \frac{.021 \times 54.9}{3.5}\right)\frac{V^2}{2g}$$

$$= 1.43\,\frac{V^2}{2g}$$

$$\therefore V = \sqrt{\frac{2gH_T}{1.43}} = 0.84\sqrt{2gH_T}$$

$$Q = AV = 0.84A\sqrt{2gH_T}$$

$$= 0.84 \times \frac{\pi}{4}(3.5)^2\sqrt{64.4 \times (99 - 86.4)}$$

$$= 0.84 \times 0.785 (3.5)^2\sqrt{64.4 \times 12.86}$$

$$= 232 \text{ cfs}$$

$$Q_T = 232 \times 3 = 696 \text{ cfs} > 538 \text{ cfs}$$

$$\boxed{Q_{SP} = 538 \text{ cfs}}$$

W.L. at EL 100 (415.06 MSL)

a) Weir flow:

$$Q = 3.03 \times 60 \times 3.06^{1.5}$$
$$= 973 \text{ cfs.}$$

b) Maximum open channel flow

$$Q_T \simeq 528 \text{ cfs}$$

c) Pressure flow:

$$Q = 0.84 A \sqrt{2gH_T}$$
$$= 0.84 \times .785 \times 3.5^2 \sqrt{64.4 \times 13.86}$$
$$= 241 \text{ cfs}$$

$$Q_T = 723 \text{ cfs} < 973 \text{ cfs}.$$

d) Sluice flow: As the inlet is somewhat rounded sluice flow may not occur

$$\therefore \boxed{Q_{sp} = 723 \text{ cfs}}$$

W.L. at EL 101

$$Q_{sp} = 0.84 \times 3 \times .785 \times 3.5^2 \sqrt{64.4 \times 14.86}$$

$$\boxed{Q_{sp} = 750 \text{ cfs}}$$

USE THE FOLLOWING EQUATION FOR SPILLWAY DISCHARGES FOR W.L. ABOVE EL 101.

$$Q_{sp} = 3(0.84 A \sqrt{2gH_T})$$

ECI-4 ENGINEERING CONSULTANTS, INC.

NEW JERSEY (STATE) DAM SAFETY INSPECTION — SHEET NO. 7 OF 7

HALSDON RESERVOIR DAM — JOB NO. 1212-001

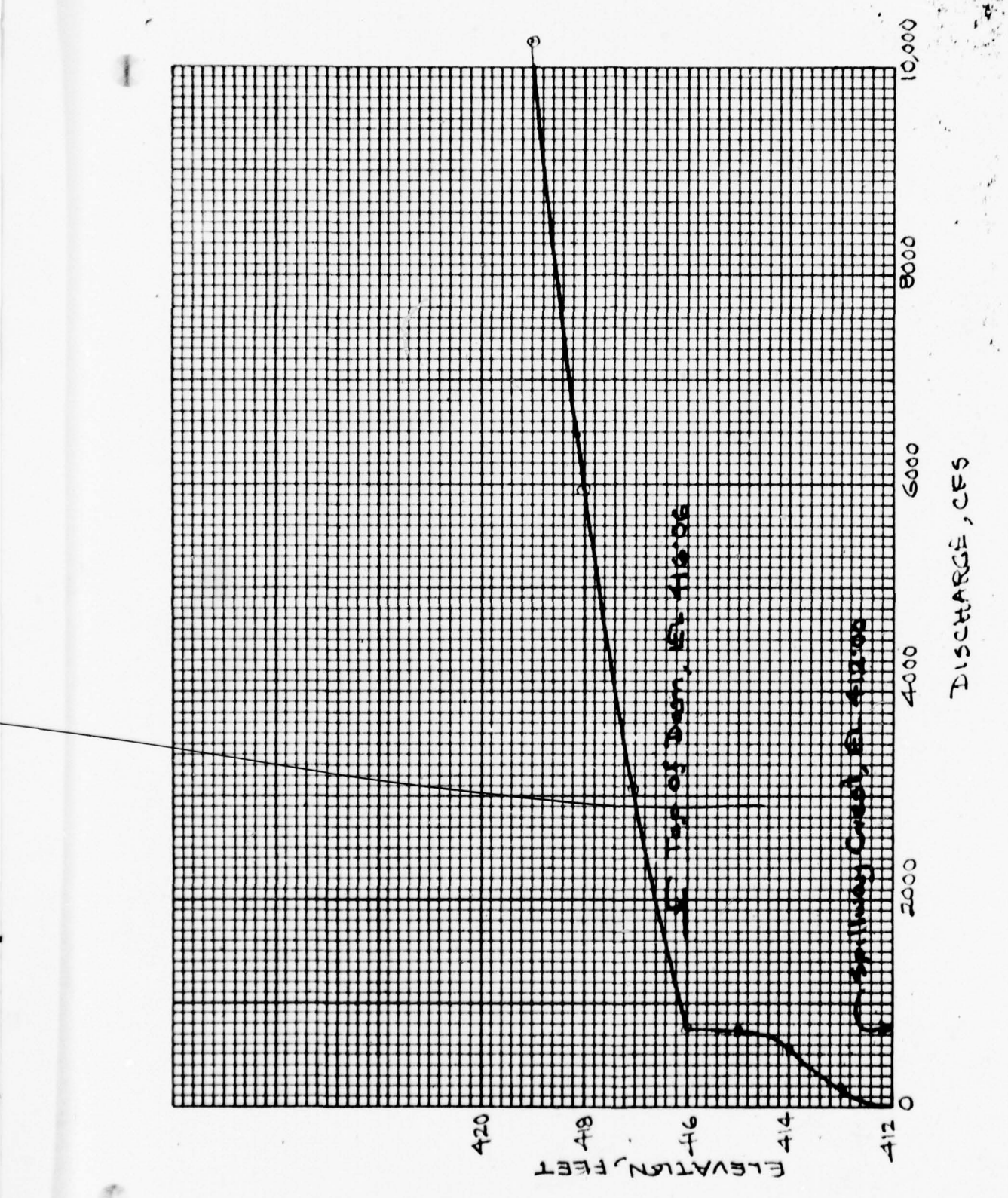
SPILLWAY & OVERTOP RATING CURVE — BY MAS — DATE 8-3-7[illegible]

Lim

TOTAL SPILLWAY & OVERTOP DISCHARGES

Reference Elev. (Assumed MSL)	Head on Spillway Crest Ft.	H_T	H_1	L_1	C_1	Discharge through Spillway, Q_{sp}, cfs	Discharge over the top of dam $Q_1 = C_1 L_1 H_1^{1.5}$ cfs	Total Discharge $Q_{sp}+Q_1$ cfs
96.94 (412)	0							0
98 (413.06)	1.06					198		198
99 (414.06)	2.06					538		538
100 (415.06)	3.06	13.6				723		723
101 (416.06)	4.06	14.6	0			750		750
102 (417.06)	5.06	15.6	1	600	3.03	774	1818	2,592
103 (418.06)	6.06	16.6	2	600	3.03	798	5142	5,940
104 (419.06)	7.06	17.6	3	600	3.03	822	9446	10,268
105 (420.06)	8.06	18.6	4	600	3.03	845	14,544	15,389

PLATE 2, APPENDIX-D



HALEDON RESERVOIR DAM
SPILLWAY AND OVERTOP
RATING CURVE

ENGINEERING CONSULTANTS, INC.

NEW JERSEY (STATE) DAM SAFETY INSPECTION SHEET NO. 1 OF
HALEDON RESERVOIR DAM JOB NO. 1212-001
RESERVOIR AREA-CAPACITY DATA BY MAS DATE 8-4-

HALEDON RESERVOIR DAM

RESERVOIR AREA CAPACITY DATA

Maximum Storage = 823 AF

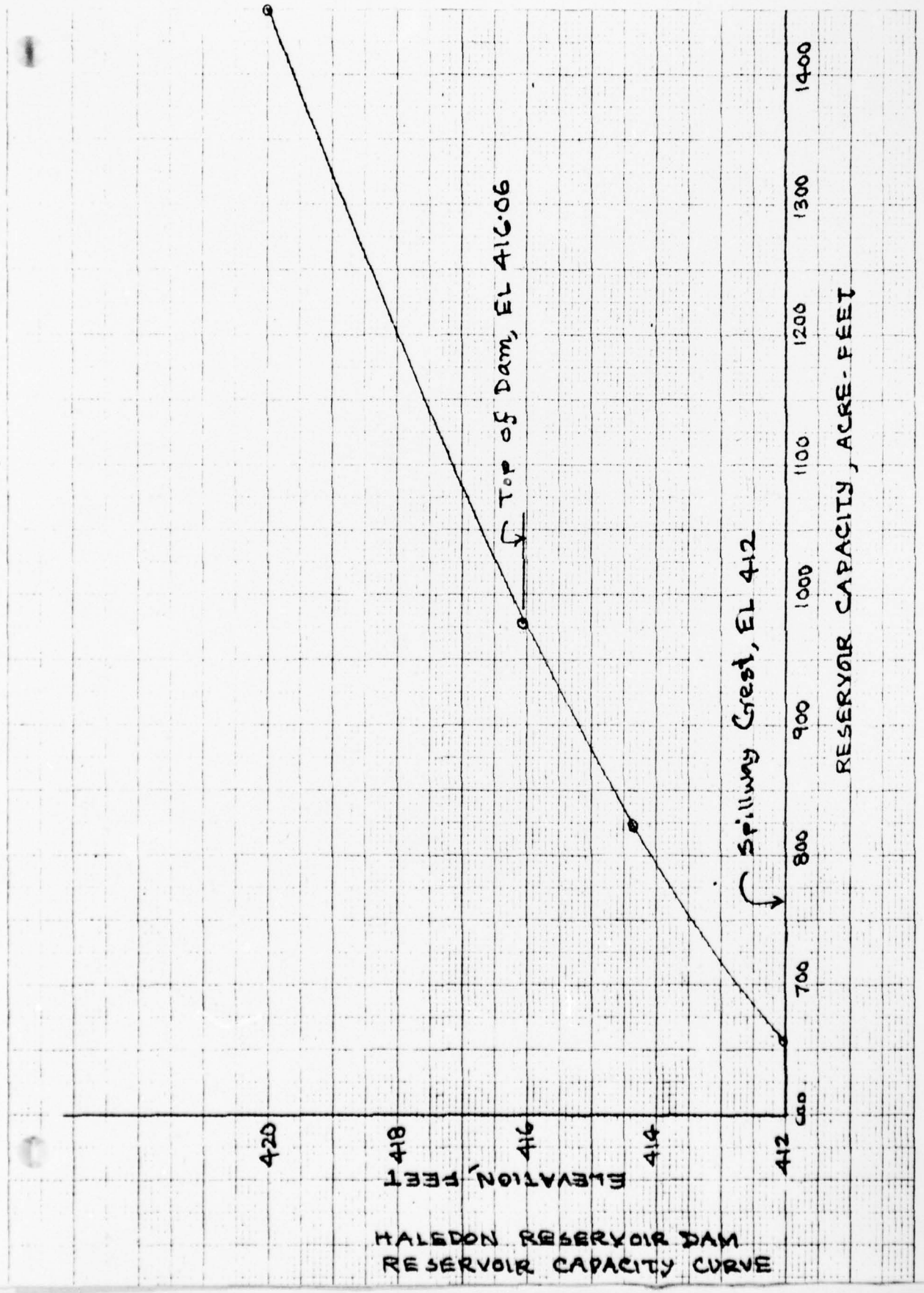
Normal Storage = 657 AF

Reservoir Surface Area = 58 acres at Elev 412 (from USGS topo maps)

Reservoir Surface Area = 140 acres at EL 420

Assumed Elev (MSL) Ft.	Reservoir Surface Area Acres	Reservoir Volume AF	Remarks
412 (Spillway Crest)	58	657	The normal volume of 657 AF is assumed at the crest of the drop inlet spillway
414.35	83±	823	
41606 (Top of dam)	99	979	
420	140	1450	

PLATE 5, APPENDIX D



HALEDON RESERVOIR DAM
RESERVOIR CAPACITY CURVE

EC1-4 **ENGINEERING CONSULTANTS, INC.**

NEW JERSEY (STATE) DAM SAFETY INSPECTION — SHEET NO. 1 OF ____
HALEDON RESERVOIR DAM — JOB NO. 1211-001
SYNTHETIC UNIT HYDROGRAPH — BY RCL — DATE 6-30

Qpk

UNIT HYDROGRAPH - HALEDON RESERVOIR DAM

A) DRAINAGE AREA, $A = 1.4$ sq mi.

B) $L = 1.17$ miles

C) $T_c = \left[\frac{11.9\,L^3}{\Delta H}\right]^{0.385} = \left[\frac{11.9(1.17)^3}{123}\right]^{0.385}$

$= 0.49$ hrs $= 0.50$ hrs.

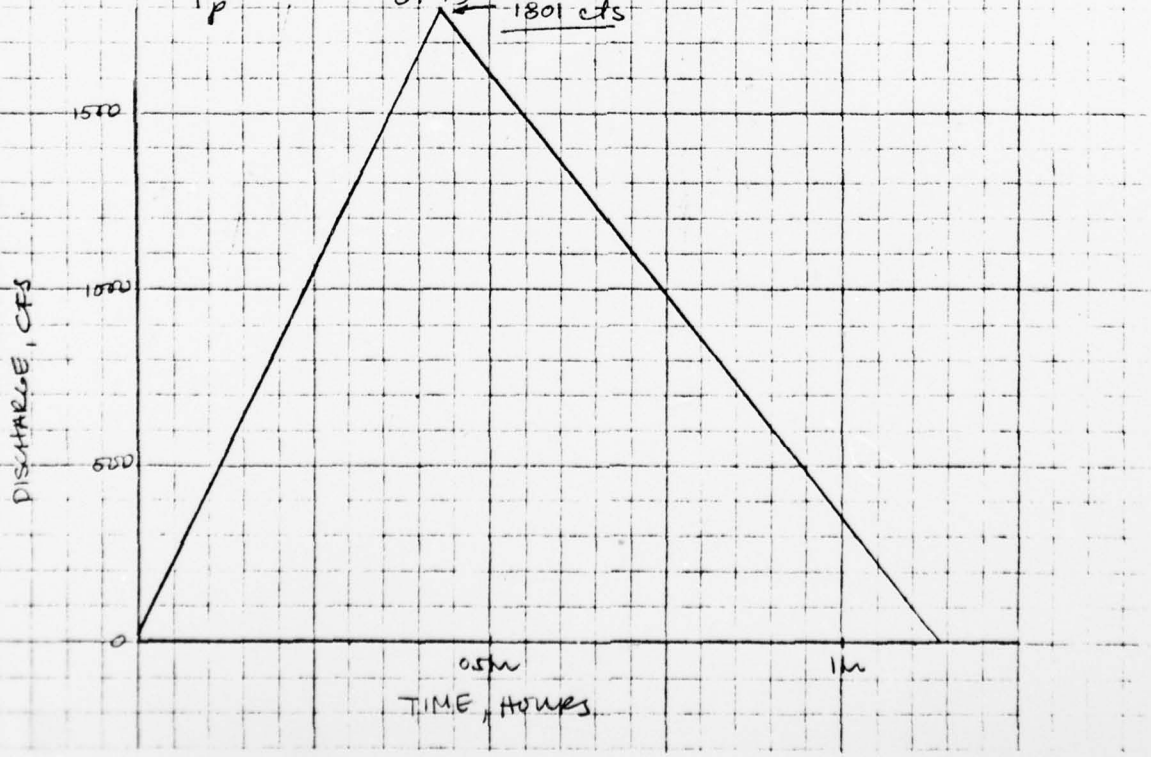
D) ASSUME $D \approx \frac{1}{2} T_c = 0.25$ hrs.

E) $T_p = \frac{D}{2} + 0.6\,T_c$

$= 0.125 + 0.6(.50) = 0.425$ hrs $\simeq 0.43$ hrs.

F) $T_b = 2.67\,T_p = 1.14$ hrs.

G) $q_p = \frac{484\,A}{T_p} = \frac{484(1.4)}{0.43} = 1801$ cfs

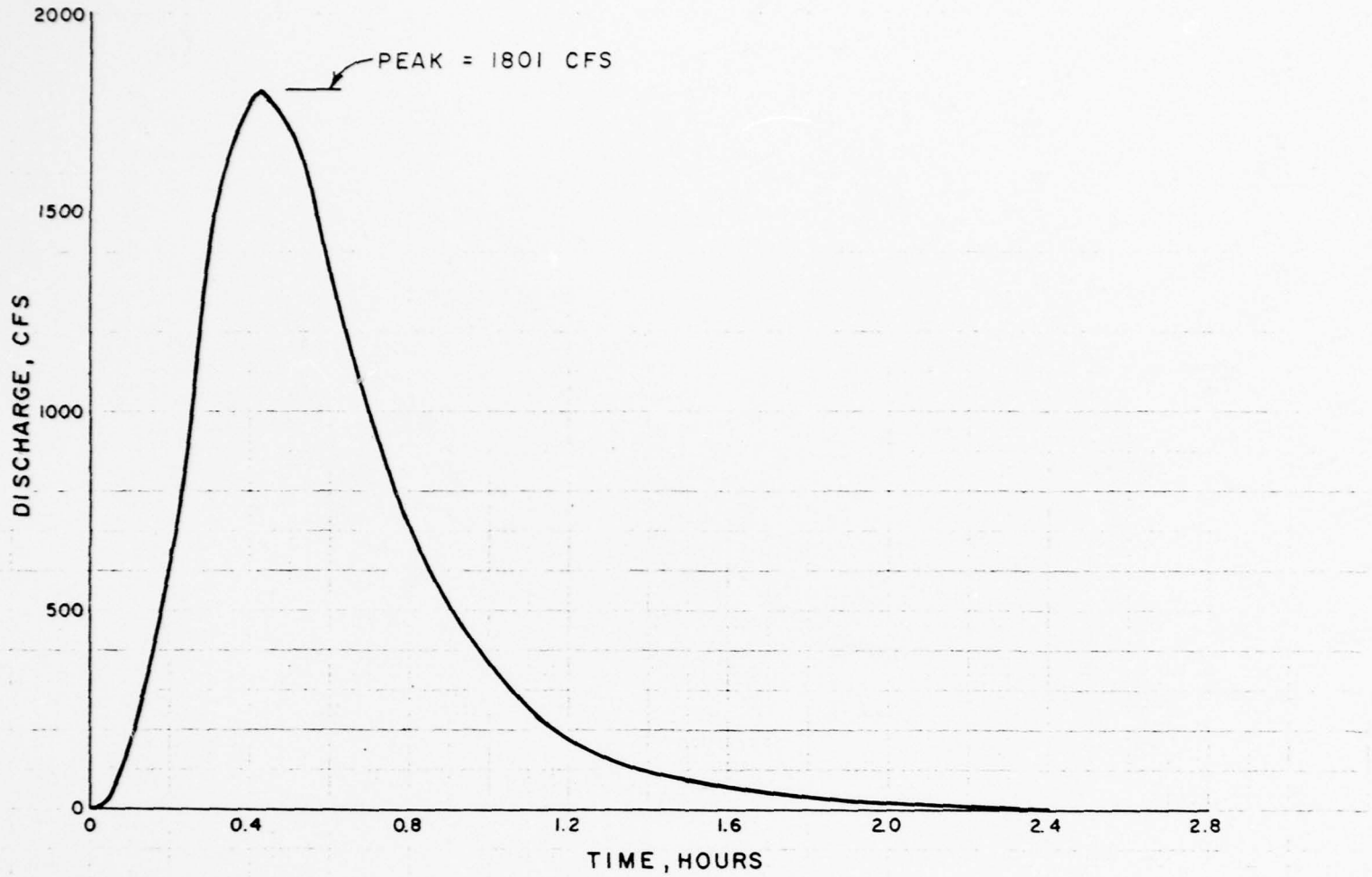


ECI-4 ENGINEERING CONSULTANTS, INC.

NEW JERSEY (STATE) DAM SAFETY INSPECTION — SHEET NO. 2 OF
HALEDON RESERVOIR DAM — JOB NO. 1212-001
UNIT HYDROGRAPH — BY MAS DATE 6-30-7

d) CURVILINEAR UNIT HYDROGRAPH

TIME RATIO T/Tp	DISCHARGE RATIO q/qp	UNIT GRAPH TIME, T hrs.	UNIT GRAPH DISCHARGE q CFS
0	0	0	0
0.1	0.015	0.043	27
0.2	0.075	0.086	135
0.3	0.16	0.13	288
0.4	0.28	0.17	504
0.5	0.43	0.22	774
0.6	0.60	0.26	1081
0.7	0.77	0.30	1387
0.8	0.89	0.34	1603
0.9	0.97	0.39	1747
1.0	1.00	0.43	1801
1.1	0.98	0.47	1764
1.2	0.92	0.52	1657
1.3	0.84	0.56	1573
1.4	0.75	0.60	1351
1.5	0.66	0.65	1188
1.6	0.56	0.69	1009
1.8	0.42	0.77	756
2.0	0.32	0.86	576
2.2	0.24	0.95	432
2.4	0.18	1.03	324
2.6	0.13	1.12	234
2.8	0.098	1.20	177
3.0	0.075	1.29	135
3.5	0.036	1.57	65
4.0	0.018	1.72	32
4.5	0.009	1.94	16
5.0	0.004	2.15	7



HALEDON RESERVOIR
0.25 HR. UNIT HYDROGRAPH

PMF Derivation – Haleden Dam
Probable Maximum Precipitation

SHEET NO. ____ OF ____
JOB NO. 212
BY YIN DATE July 1978

PROBABLE MAXIMUM FLOOD CALCULATION (PMF)

DRAINAGE = 1.6 sq. mi

From Hydrometeorological Report "33" Seasonal Variation of the Probable Maximum Precipitation East of the 105th Meridian for Areas from 10 to 1,000 Square Miles and Duration of 6, 12, 24 and 48 Hours" 1956

For D.A. = 10 sq. mi.
6 hour rain fall duration.
PMP = 25.0" for Zone 6 at Haleden Basin.

Since D.A. < 10 sq mi. No area reduction to be applied.
PMP values for varies rain fall duration

Duration	PMP (inch)	
6 Hr	1 ×	= 25.0"
12 Hr	1.09 ×	= 27.25"
24 Hr	1.17 ×	= 29.25"
48 Hr.	1.26 ×	= 31.50"

PMP values are reduced by 20% to account for misalignment of Basin and storm [illegible]

Duration	PMP
6 Hr	20.0"
12 Hr	[illegible]
24 Hr	[illegible]
48 Hr	[illegible]

Can be neglected.

ECI-4 ENGINEERING CONSULTANTS, INC.

NEW JERSEY DAM SAFETY INSPECTION (DSP)
PMF DERIVATION - HALEDON DAM
PROBABLE MAXIMUM PRECIPITATION

SHEET NO. ____ OF ____
JOB NO. 1212
BY YLN DATE ____

DA = 1.6

PMP. PMF DERIVATION:

1) SOIL GROUP "C", & AMC = II.

2). CN = 85

MIN LOSS RATE FOR ABOVE CONDITION = 0.12"/hr

FOR CN = 85,

S = 1.76 in the

EQ. $Q = (P - 0.2S)^2 / P + 0.8S$.

OR $Q = (P - 0.362)^2 / P + 1.408$.

CI-4 **ENGINEERING CONSULTANTS, INC.**

NEW JERSEY DAM SAFETY INSPECTION — (DEP) SHEET NO. 1 OF
PMF DERIVATION — HELEDON DAM JOB NO. 1213-001-1
DIRECT RUNOFF BY KLB DATE 7-28-78

DIRECT RUNOFF INCREMENTS FOR COMPUTING PMF

TIME ENDING (HR)	INCREMENTAL DESIGN RAINFALL (IN)	ACCUMULATIVE DESIGN RAINFALL (IN)	DIRECT RUNOFF ACCUMULATIVE (IN)	DIRECT RUNOFF INCREMENTAL (IN)	INCREMENTAL LOSS
0.25	0.50	0.50	0.01	0.00	0.01
0.50	0.50	1.00	0.17	0.16	0.34
0.75	0.50	1.50	0.45	0.28	0.22
1.00	0.50	2.00	0.80	0.35	0.15
1.25	0.60	2.60	1.26	0.46	0.14
1.50	0.60	3.20	1.76	0.50	0.10
1.75	0.60	3.80	2.28	0.52	0.08
2.00	0.60	4.40	2.82	0.54	0.06
2.25	0.75	5.15	3.51	0.69	0.06
2.50	0.75	5.90	4.21	0.70	0.05
2.75	0.75	6.65	4.92	0.71	0.04
3.00	0.75	7.40	5.69	0.77	0.03*
3.25	1.77	9.17	7.35	1.74	0.03
3.50	1.78	10.95	9.09	1.75	0.03
3.75	2.28	13.23	11.33	2.25	0.03
4.00	1.77	15.00	13.08	1.74	0.03
4.25	0.70	15.70	13.77	0.67	0.03
4.50	0.70	16.40	14.46	0.67	0.03
4.75	0.70	17.10	15.16	0.67	0.03
5.00	0.70	17.80	15.85	0.67	0.03
5.25	0.55	18.35	16.39	0.52	0.03
5.50	0.55	18.90	16.94	0.52	0.03
5.75	0.55	19.45	17.49	0.52	0.03
6.00	0.55	20.00	18.03	0.52	0.03

* MINIMUM LOSS RATE = 0.12"/HR = 0.03/.25HR
(AFTER THIS LEVEL IS REACHED, ABANDON CURVE FOR 0.03"/.25HR LOSS)

HEC-1 - COMPUTATIONS

I-4 ENGINEERING CONSULTANTS, INC.

NEW JERSEY (STATE) DAM SAFETY INSPECTION SHEET NO. 1 OF ____
HALEDON RESERVOIR JOB NO. 1212-001-1
INPUT TO HEC-1 BY KLB DATE 8-4-7

Gin

INPUT TO HEC-1

#	ELEV (FT)	HEAD ABOVE SPILLWAY (FT)	Y2 STORAGE (AC-FT)	Y3 DISCHARGE (CFS
1	412.0 (SPILLWAY CREST)	0.00	657.	0.
2	414.0	2.00	794.	550.
3	415.0	3.00	881.	725.
4	415.5	3.50	929.	738.
5	415.9	3.90	967.	744.
6	416.06 (TOP OF DAM)	4.06	978.	750.
7	416.1	4.10	987.	950.
8	416.5	4.50	1028.	1800.
9	417.0	5.00	1083	3000.
10	419.0	7.00	1325	10268

****
HEC-1 VERSION DATED JAN 1973

****

DAM SAFETY INSPECTION - NEW JERSEY STATE
HALEDON RESERVOIR
PMF FLOOD ROUTING

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
50	0	15	0	0	0	0	0	0	0

JOPER	NWT
3	0

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INPUT UNIT HYDROGRAPH DERIVED FROM SCS METHOD

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
8	0	0	0	0	0	1

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
0	-1	1.60	0.00	1.60	0.00	0.000	0	0	0

PRECIP DATA

NP	STORM	DAJ	DAK
24	0.00	0.00	0.00

PRECIP PATTERN

0.00	0.16	0.28	0.35	0.46	0.50	0.52	0.54	0.69	0.70
0.71	0.72	1.74	1.75	2.25	1.74	0.67	0.67	0.67	0.67
0.52	0.52	0.52	0.52						

LOSS DATA

STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

GIVEN UNIT GRAPH, NUMGG= 10

0. 910. 1801. 830. 360. 150. 75. 40. 20. 5.

UNIT GRAPH TOTALS 4191. CFS OR 1.01 INCHES OVER THE AREA

RECESSION DATA

STRTQ= 0.00 QRCSN= 0.00 RTIOR= 1.00

END-OF-PERIOD FLOW

TIME	RAIN	EXCS	COMP Q
1	0.00	0.00	0.
2	0.16	0.16	0.
3	0.28	0.28	145.
4	0.35	0.35	542.
5	0.46	0.46	955.
6	0.50	0.50	1338.
7	0.52	0.52	1698.
8	0.54	0.54	1935.

9	0.69	0.69	2088.
10	0.70	0.70	2321.
11	0.71	0.71	2644.
12	0.72	0.72	2816.
13	1.74	1.74	2914.
14	1.75	1.75	3898.
15	2.25	2.25	5770.
16	1.74	1.74	7102.
17	0.67	0.67	7920.
18	0.67	0.67	6601.
19	0.67	0.67	4510.
20	0.67	0.67	3555.
21	0.52	0.52	3151.
22	0.52	0.52	2841.
23	0.52	0.52	2481.
24	0.52	0.52	2306.
25	0.00	0.00	2228.
26	0.00	0.00	1727.
27	0.00	0.00	779.
28	0.00	0.00	341.
29	0.00	0.00	151.
30	0.00	0.00	72.
31	0.00	0.00	33.
32	0.00	0.00	15.
33	0.00	0.00	2.
34	0.00	0.00	0.
35	0.00	0.00	0.
36	0.00	0.00	0.
37	0.00	0.00	0.
38	0.00	0.00	0.
39	0.00	0.00	0.
40	0.00	0.00	0.
41	0.00	0.00	0.
42	0.00	0.00	0.
43	0.00	0.00	0.
44	0.00	0.00	0.
45	0.00	0.00	0.
46	0.00	0.00	0.
47	0.00	0.00	0.
48	0.00	0.00	0.
49	0.00	0.00	0.
50	0.00	0.00	0.
SUM	17.87	17.87	74895.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	7920.	3088.	1497.	1497.	74893.
INCHES		17.95	18.14	18.14	18.14
AC-FT		1532.	1548.	1548.	1548.

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTE HYDROGRAPH THRU HALEDON RESERVOIR

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
8	1	0	0	2	0	1

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME
0.0	0.000	0.00	1	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA
0	0	0	0.000	0.000	0.000	-1.

STORAGE=	657.	794.	881.	929.	967.	978.	987.	1028.	1083.	1325.
OUTFLOW=	0.	550.	725.	738.	744.	750.	950.	1800.	8000.	10268.

TIME	EOP STOR	AVG IN	EOP OUT
1	657.	0.	0.
2	657.	0.	0.
3	658.	72.	5.
4	665.	344.	32.
5	679.	749.	89.
6	700.	1147.	174.
7	727.	1518.	281.
8	757.	1817.	403.
9	789.	2011.	531.
10	823.	2205.	608.
11	861.	2483.	685.
12	902.	2730.	730.
13	946.	2865.	740.
14	997.	3406.	1169.
15	1059.	4834.	2490.
16	1123.	6436.	4212.
17	1175.	7511.	5775.
18	1198.	7261.	6478.
19	1184.	5555.	6041.
20	1152.	4032.	5090.
21	1125.	3353.	4267.
22	1105.	2996.	3665.
23	1089.	2661.	3190.
24	1076.	2393.	2854.
25	1066.	2267.	2638.
26	1055.	1977.	2395.
27	1036.	1253.	1975.
28	1012.	560.	1468.
29	991.	246.	1037.
30	975.	112.	748.
31	960.	53.	743.
32	945.	23.	740.
33	930.	7.	738.
34	915.	1.	734.
35	900.	0.	730.
36	885.	0.	726.
37	870.	0.	704.
38	856.	0.	675.
39	842.	0.	648.
40	829.	0.	621.
41	817.	0.	596.
42	804.	0.	572.
43	793.	0.	547.
44	782.	0.	504.
45	772.	0.	463.
46	763.	0.	426.
47	754.	0.	392.
48	747.	0.	361.
49	739.	0.	332.
50	733.	0.	306.

SUM 71352.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	6478.	2527.	1427.	1427.	71352.
INCHES		14.69	17.28	17.28	17.28
AC-FT		1253.	1474.	1474.	1474.

RUNOFF SUMMARY, AVERAGE FLOW

		PEAK	6-HOUR	24-HOUR	72-HOUR	AREA
HYDROGRAPH AT	8	7920.	3088.	1497.	1497.	1.60
ROUTED TO	8	6478.	2527.	1427.	1427.	1.60

****
HEC-1 VERSION DATED JAN 1973

****

DAM SAFETY INSPECTION - NEW JERSEY STATE
HALEDON RESERVOIR
ONE HALF PMF FLOOD ROUTING

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
50	0	15	0	0	0	0	0	0	0

JOPER NWT
3 0

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INPUT UNIT HYDROGRAPH DERIVED FROM SCS METHOD

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
8	0	0	0	0	0	1

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
0	-1	1.60	0.00	1.60	0.00	0.500	0	0	0

PRECIP DATA

NP	STORM	DAJ	DAK
24	0.00	0.00	0.00

PRECIP PATTERN

0.00	0.16	0.28	0.35	0.46	0.50	0.52	0.54	0.69	0.70
0.71	0.72	1.74	1.75	2.25	1.74	0.67	0.67	0.67	0.67
0.52	0.52	0.52	0.52						

LOSS DATA

STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

GIVEN UNIT GRAPH, NUHGQ= 10

0.	910.	1801.	830.	360.	150.	75.	40.	20.	5.

UNIT GRAPH TOTALS 4191. CFS OR 1.01 INCHES OVER THE AREA

RECESSION DATA

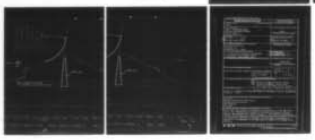
STRTQ= 0.00 QRCSN= 0.00 RTIOR= 1.00

END-OF-PERIOD FLOW

TIME	RAIN	EXCS	COMP Q
1	0.00	0.00	0.
2	0.16	0.16	0.
3	0.28	0.28	145.
4	0.35	0.35	542.
5	0.46	0.46	955.
6	0.50	0.50	1338.
7	0.52	0.52	1698.
8	0.54	0.54	1935.

AD-A060 013 HARRIS ECI ASSOCIATES WOODBRIDGE NJ F/G 13/2
NATIONAL DAM SAFETY PROGRAM. HALEDON RESERVOIR (NJ00021), PASSA--ETC(U)
AUG 78 R GERSHOWITZ DACW61-78-C-0124
UNCLASSIFIED NL

2 OF 2
AD
A060013



END
DATE
FILMED
12-78
DDC

9	0.69	0.69	2088.
10	0.70	0.70	2321.
11	0.71	0.71	2644.
12	0.72	0.72	2816.
13	1.74	1.74	2914.
14	1.75	1.75	3898.
15	2.25	2.25	5770.
16	1.74	1.74	7102.
17	0.67	0.67	7920.
18	0.67	0.67	6601.
19	0.67	0.67	4510.
20	0.67	0.67	3555.
21	0.52	0.52	3151.
22	0.52	0.52	2841.
23	0.52	0.52	2481.
24	0.52	0.52	2306.
25	0.00	0.00	2228.
26	0.00	0.00	1727.
27	0.00	0.00	779.
28	0.00	0.00	341.
29	0.00	0.00	151.
30	0.00	0.00	72.
31	0.00	0.00	33.
32	0.00	0.00	13.
33	0.00	0.00	2.
34	0.00	0.00	0.
35	0.00	0.00	0.
36	0.00	0.00	0.
37	0.00	0.00	0.
38	0.00	0.00	0.
39	0.00	0.00	0.
40	0.00	0.00	0.
41	0.00	0.00	0.
42	0.00	0.00	0.
43	0.00	0.00	0.
44	0.00	0.00	0.
45	0.00	0.00	0.
46	0.00	0.00	0.
47	0.00	0.00	0.
48	0.00	0.00	0.
49	0.00	0.00	0.
50	0.00	0.00	0.
SUM	17.87	17.87	74895.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	7920.	3088.	1497.	1497.	74893.
INCHES		17.95	18.14	18.14	18.14
AC-FT		1532.	1548.	1548.	1548.

RUNOFF MULTIPLIED BY 0.50

0.	0.	72.	271.	477.	669.	849.	967.	1044.	1160.
1322.	1408.	1457.	1949.	2885.	3551.	3960.	3300.	2255.	1777.
1575.	1420.	1240.	1153.	1114.	863.	389.	170.	75.	36.
16.	6.	1.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3960.	1544.	748.	748.	37446.
INCHES		8.97	9.07	9.07	9.07
AC-FT		766.	774.	774.	774.

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTE HYDROGRAPH THRU HALEDON RESERVOIR

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
8	1	0	0	2	0	1

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME
0.0	0.000	0.00	1	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA
0	0	0	0.000	0.000	0.000	-1.

STORAGE=	657.	794.	881.	929.	967.	978.	987.	1028.	1083.	1825.
OUTFLOW=	0.	550.	725.	738.	744.	750.	950.	1800.	3000.	10268.

TIME	EOP STOR	AVG IN	EOP OUT
1	657.	0.	0.
2	657.	0.	0.
3	657.	56.	2.
4	661.	172.	16.
5	668.	374.	44.
6	678.	573.	87.
7	692.	759.	140.
8	707.	908.	201.
9	723.	1005.	265.
10	739.	1102.	332.
11	757.	1241.	404.
12	776.	1365.	481.
13	795.	1432.	553.
14	819.	1703.	600.
15	855.	2417.	674.
16	907.	3218.	732.
17	970.	3755.	745.
18	1020.	3630.	1643.
19	1039.	2777.	2054.
20	1039.	2016.	2040.
21	1032.	1676.	1906.
22	1025.	1498.	1758.
23	1018.	1330.	1607.
24	1011.	1196.	1462.
25	1006.	1133.	1346.
26	1000.	988.	1220.
27	989.	626.	1010.
28	977.	280.	749.
29	964.	128.	743.
30	950.	96.	741.
31	935.	86.	739.
32	920.	11.	735.
33	905.	8.	731.
34	890.	0.	727.
35	875.	0.	714.
36	861.	0.	685.
37	847.	0.	657.
38	834.	0.	630.

39	821.	0.	604.	
40	809.	0.	580.	
41	797.	0.	556.	
42	786.	0.	518.	
43	775.	0.	477.	
44	766.	0.	439.	
45	757.	0.	404.	
46	749.	0.	372.	
47	742.	0.	342.	
48	735.	0.	315.	
49	729.	0.	290.	
50	728.	0.	267.	
SUM			34360.	

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2054.	1085.	687.	687.	34360.
INCHES		6.31	8.32	8.32	8.32
AC-FT		536.	710.	710.	710.

RUNOFF SUMMARY, AVERAGE FLOW

		PEAK	6-HOUR	24-HOUR	72-HOUR	AREA
HYDROGRAPH AT	8	3960.	1544.	748.	748.	1.60
ROUTED TO	8	2054.	1085.	687.	687.	1.60

****
HEC-1 VERSION DATED JAN 1978

****

DAM SAFETY INSPECTION - NEW JERSEY STATE
HALEDON RESERVOIR
PERCENT OF PMF FLOOD ROUTING

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
50	0	15	0	0	0	0	0	4	0

JOPER	NWT
5	0

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INPUT UNIT HYDROGRAPH DERIVED FROM SCS METHOD

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
8	0	0	0	0	0	1

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
0	-1	1.60	0.00	1.60	0.00	0.350	0	0	0

LOSS DATA

STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

RECESSION DATA

STRTQ= 0.00 QRCSN= 0.00 RTIOR= 1.00

END-OF-PERIOD FLOW

	TIME	RAIN	EXCS	COMP Q
SUM		17.87	17.87	74895.

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTE HYDROGRAPH THRU HALEDON RESERVOIR

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
8	1	0	0	0	0	1

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME
0.0	0.000	0.00	1	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA
0	0	0	0.000	0.000	0.000	-1.

STORAGE=	697.	794.	881.	929.	967.	978.	987.	1028.	1088.	1089.
OUTFLOW=	0.	550.	725.	738.	744.	750.	950.	1800.	3000.	10268.

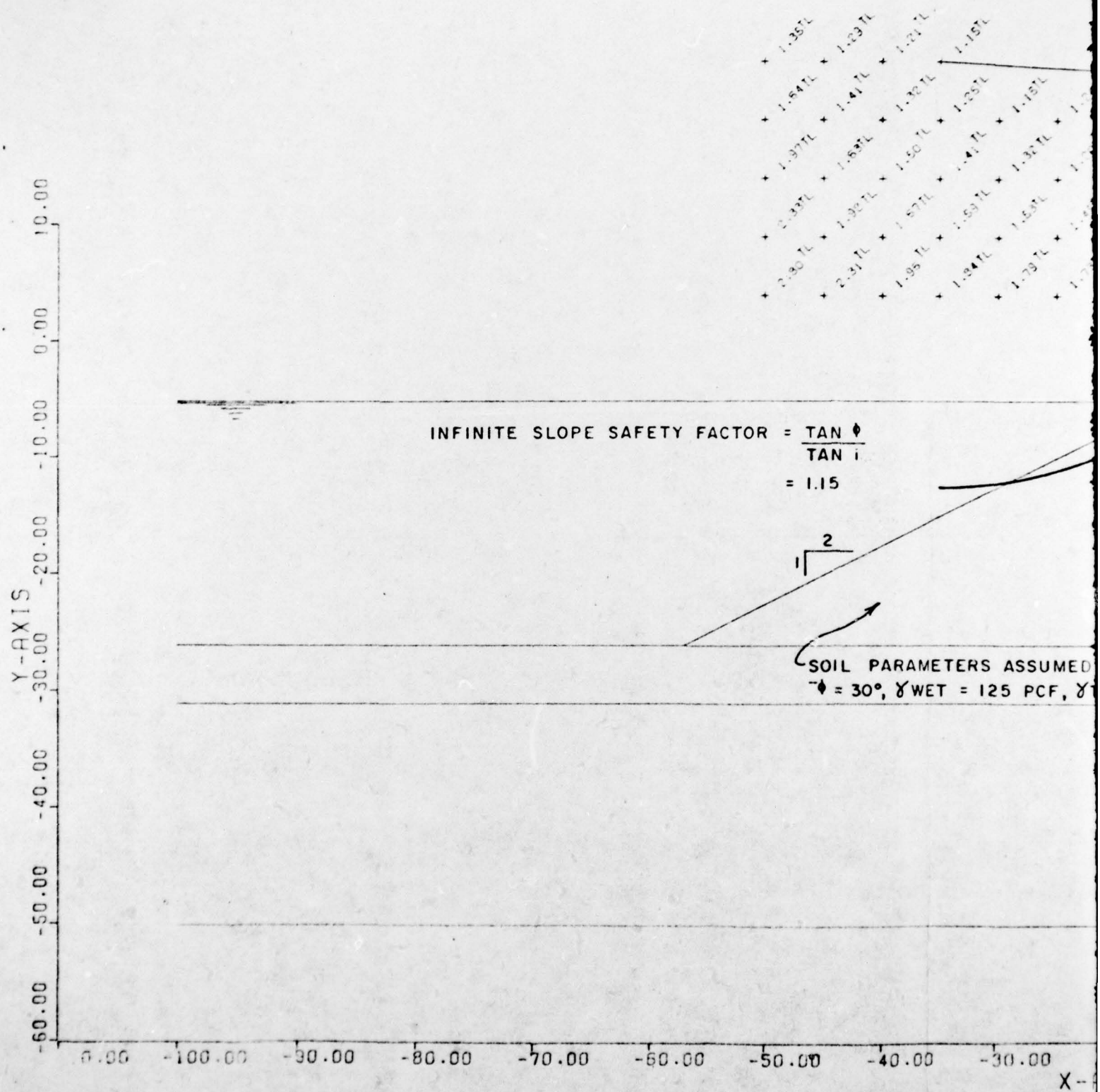
RUNOFF SUMMARY: AVERAGE FLOW

		PEAK	6-HOUR	24-HOUR	72-HOUR	AREA
HYDROGRAPH AT	8	2772.	1081.	524.	524.	1.60
ROUTED TO	8	744.	702.	471.	471.	1.60

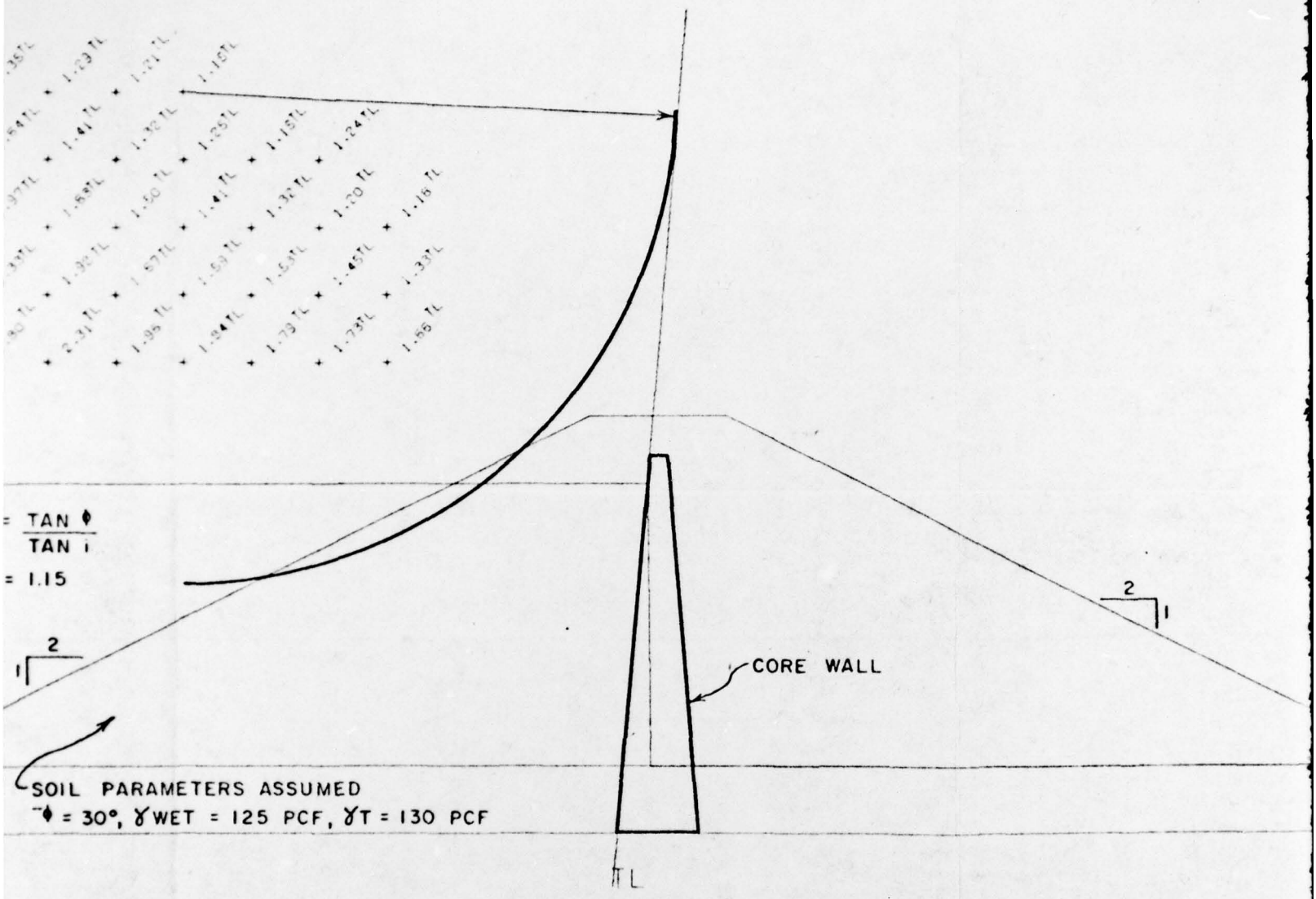
11 SOUTH NAVAJO DENVER, COLORADO 80223

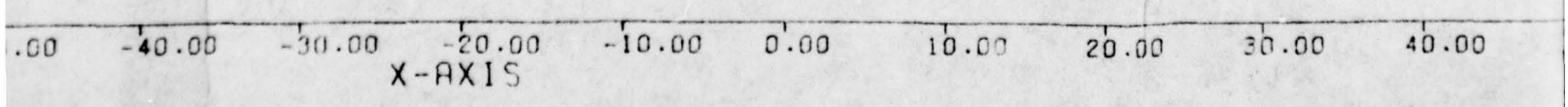
APPENDIX E

STABILITY CALCULATIONS

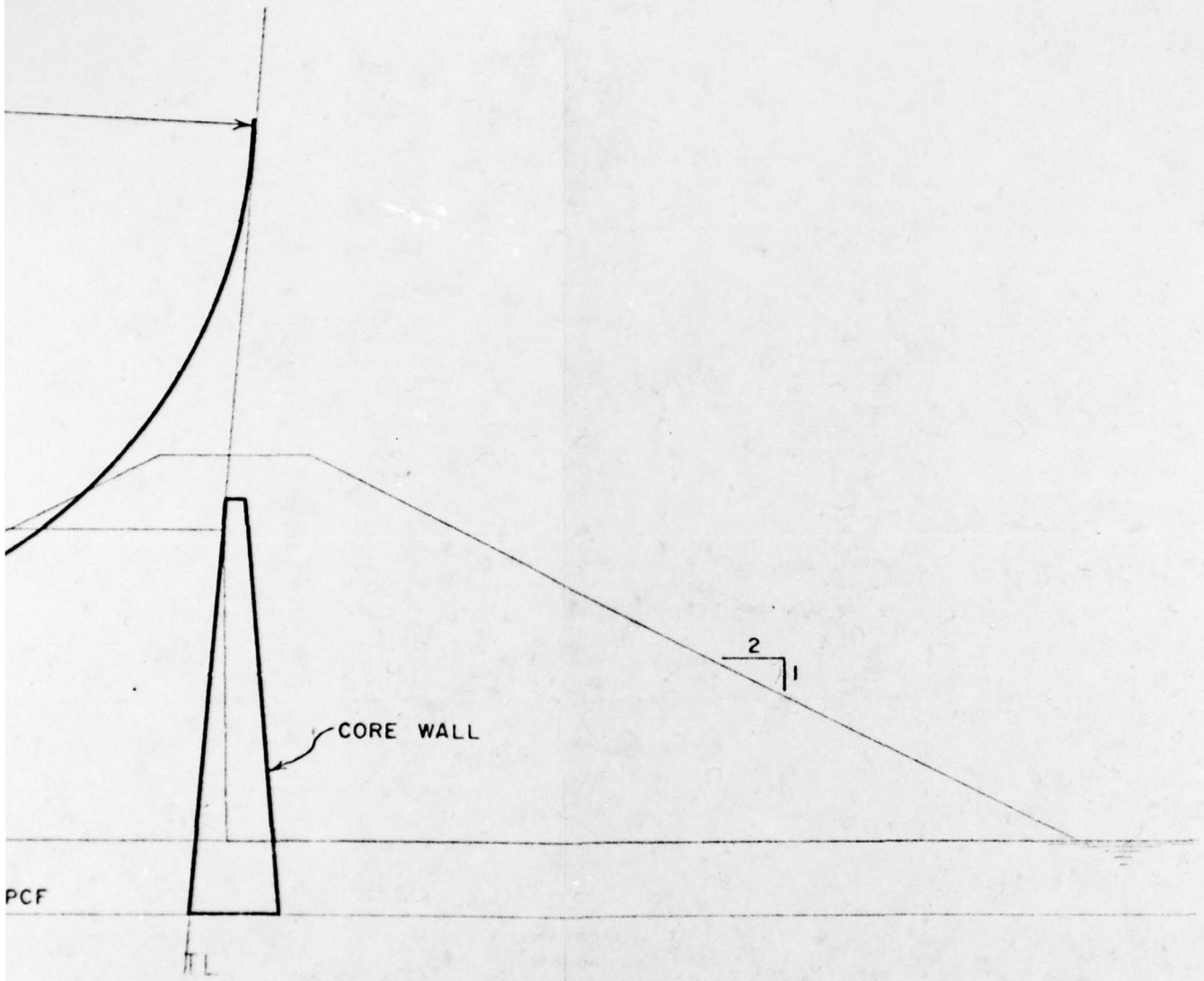


HALEDON RESERVOIR DAM SAFETY INSPECTION





ETY INSPECTION NEW JERSEY GROUP 2 AUG. 1978



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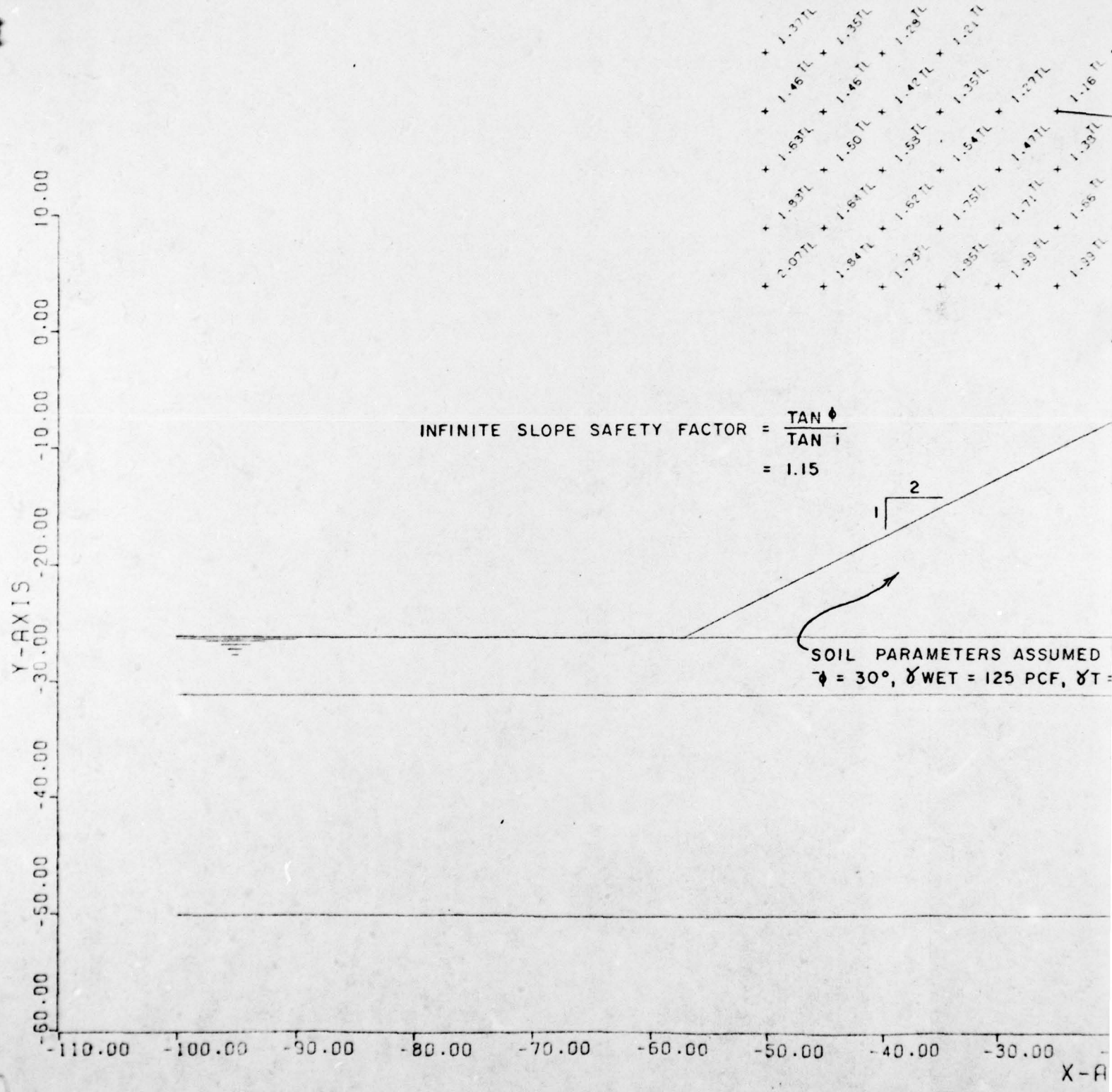
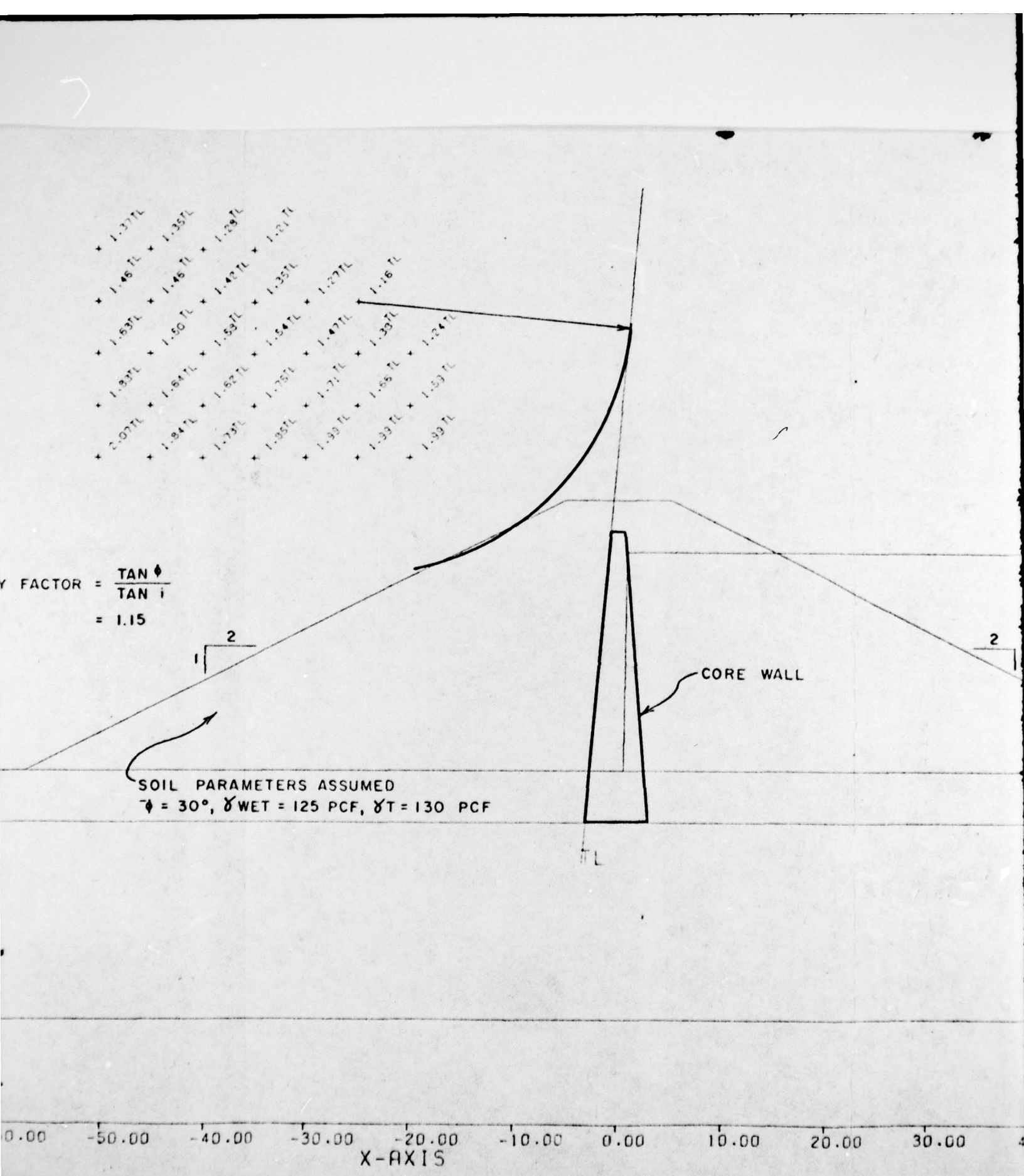
SCALE: 1"= 10'

NEW JERSEY GROUP 2 AUG. 1978

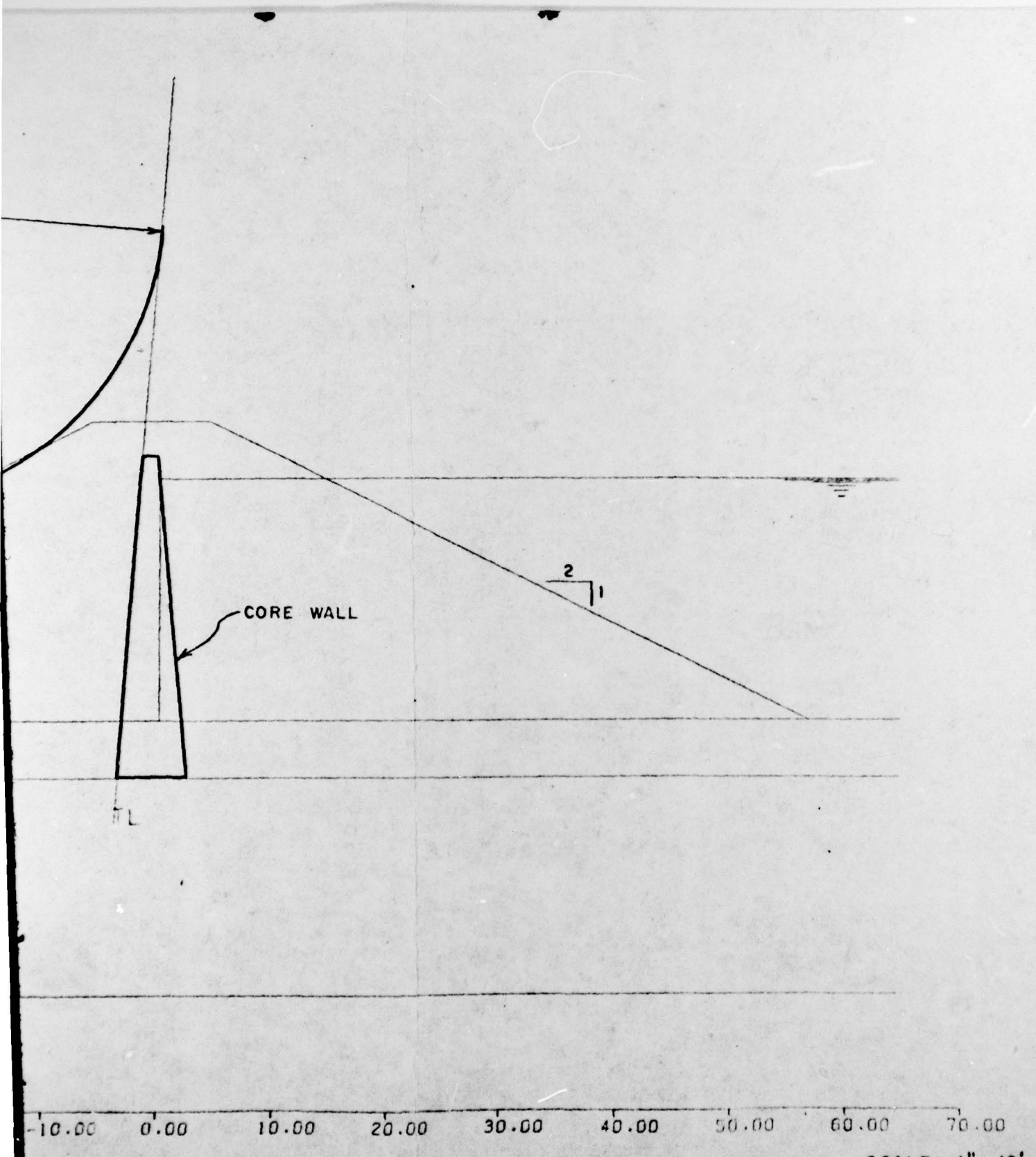
3



HALEDON RESERVOIR DAM SAFETY INSPECTION



AM SAFETY INSPECTION NEW JERSEY GROUP 2 AUG.



SCALE : 1" = 10'

W JERSEY GROUP 2 AUG. 1978

3

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

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Haledon Reservoir
Passaic County, N.J.

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18. SUPPLEMENTARY NOTES

Copies are obtainable from National Technical Information Service, Springfield, Virginia, 22151.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)
Dam--N.J.
National Dam Safety Program Phase I
Haledon Reservoir Dam, N.J.
Dam Inspection
Dam Safety

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report cites results of a technical investigation as to the dam's adequacy. The inspection and evaluation of the dam is as prescribed by the National Dam Inspection Act, Public Law 92-367. The technical investigation includes visual inspection, review of available design and construction records, and preliminary structural and hydraulic and hydrologic calculations, as applicable. An assessment of the dam's general condition is included in the report.

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